THE IRON TRADE REVIEW

VOLUME XXXV CLEVELAND, OHIO, DECEMBER 11, 1902 NUMBER 50

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The quietness belonging to the end of the year, and the full understanding by buyers that waiting does not involve any risk of higher prices, account for the present situation in the iron trade. So much material is sold for the first half of 1903, and so much pig iron, besides certain forms of finished material, notably rails, sold for 1902 delivery, will not be manufactured until the early part of next year, that there is no reason for any special activity now. Meantime the conspicuous feature of recent readjustments of prices in four lines of finished material—wrought pipe, wire products, sheets and tin plates—is the increasing disadvantage under which smaller independent producers labor, in competing with large self-contained, or "integrated" concerns. In sheets the competition is growing sharper, and here, as in tin plates, some of the independent individual mills are showing a determination not only to meet but to cut under the prices of the consolidations. The pipe and tube trade is going very largely to the main producer, the recent cuts being deep as well as thoroughly conned before the new program was announced. Some recent reports have been wide of the mark concerning the wrought pipe trade, the demand being in reality greater than at the corresponding time last year. Wire works yards and warehouses have shown an accumulation of stock for some time, but recently there has been more active shipping in anticipation of the advance in freight rates Jan. 1. In the East a project is under way to gather together several independent wire plants and build a steel works for them. Rails are still the strong feature of trade in finished lines. A contract for 150,000 tons with the Kansas City, Mexico & Orient Railroad has been closed this week for the Edgar Thomson mill. Another inquiry of 24,000 tons has come up from the South and still other business is pending. The marked accumulation of rail business and the plans for railroad extensions in the next year, taken in connection with the condition of car and locomotive works order books, are an index to prolonged prosperity that should not be neglected in connection with some of the current comment on the iron trade and declining prices. The report that the new Union Steel Co. will build a rail mill and a structural mill is not officially confirmed, but there are reasons for believing it substantially correct. The situation in the bar market is quiet with continued tendency to weakness in bar iron, sales having been made lately at 1.70c Pittsburg for common iron, or $2 less than the announced price, and it is understood 1.70c is not minimum. However, some producers are steadily quoting 1.80c, which it is well known affords no great profit at current prices for scrap. The second attempt to bring together several independent rolling mill companies centered at Chicago made considerable headway but it is now reported to have been given up in the past week. Structural mills are still booking good business. The American Bridge Co. has taken a 5,000-ton contract for the Fifth National Bank Building, Pittsburg, and a 1,500-ton contract for Buffalo, with railroad work steadily coming up. Chicago reports sales of 10,000 tons in the week. There is little probability that the basis on plates or shapes will be changed in the coming year and both agreements are expected to be renewed. Coming to primary and intermediate markets, both are inactive. Steel from abroad has sold at $26.50 seaboard, duty paid, and at Pittsburg Bessemer billets stand at $28.50 to $29. The pig iron market continues easy, with indications that domestic producers of foundry iron count on soon being able to take care of the country's requirements. Foreign iron is less sought, and prices have declined, Middlesboro No. 3 being now obtainable at $17.75 at New York, in large lots. British makers have evidently been willing to make concessions to prolong the demand from this side. Domestic spot iron is now about $2 a ton lower than at the highest point. A sale of 20,000 tons of Bessemer iron is reported at $21.25, Valley furnace, for delivery in the first half of 1903. Prices of Lake Superior ores for next year have been discussed tentatively. Some producers, apart from the steel corporation, whose views are not known, favor a slight advance, to put ore in relation to pig iron and finished material prices, and with the mine-owning contingent increasing among steel manufacturers an advance might not be difficult. Its wisdom is another question.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Dec. 10.

While there has been some improvement in the coke situation, conditions continue to fluctuate from week to week. Last Saturday 11 furnaces of the United States Steel Corporation were banked for want of fuel while 13 furnaces in the two Valleys were inoperative. The furnaces of the United States Steel Corporation that were banked were in the Chicago, Cleveland, and Ohio River districts, the Pittsburg furnaces receiving sufficient coke to keep them in fair operation. Thus far this week coke shipments from the Connellsville region have not been nearly up to the normal and there has been no betterment in conditions since the last compilation of furnaces was made on Saturday. While there seems to be a feeling among consumers that slightly lower iron will prevail after the first of the year, no great reductions can be looked for, as all furnaces continue short on deliveries. One large concern dealing in foundry and mill iron is practically two months behind on all shipments, but despite the coke scarcity it is stated that the furnaces are beginning to catch up on their orders, making a better output than at any time in three months.

In Bessemer iron we note the sale of 20,000 tons for delivery the first half of next year at $21.25 at Valley furnace. This is the first large sale of Bessemer iron for delivery next year made in some time, and fixes a new price for delivery during the first half of 1903. The foundry and forge iron market continues very quiet and the only sales noted are occasional carload lots for immediate shipment. There are many rumors that the United States Steel Corporation is again negotiating for iron for delivery through the third quarter of next year, but there is no foundation for these rumors, as it is now absolutely certain that negotiations will not be opened until after the first of the year.

New York reports regarding the status of the pipe trade in general are very interesting. Some of these provide for the shutting down of the plants of the National Tube Co. within the next few days, while others are to the effect that the trade is the worst in years. An investigation, however, shows that the National Tube Co. is closing fully 50 percent more business at the present time than at this period last year and that the output of its mills this year will break all previous records. Furthermore the outlook for next year is exceedingly bright. Since the recent reduction, jobbers are specifying heavily in merchant pipe, while the demand for the larger sizes is above the normal for this season of the year.

The sheet and tin plate trades still continue to suffer, although it is stated that the demand for tin plate is steadily increasing and that additional mills of the American Tin Plate Co. will be placed in operation from day to day. In steel bars,

the agricultural implement manufacturers are not specifying very heavily and nearly all of the mills are in position to make prompt deliveries on most sizes. A meeting of the plate and structural manufacturers is to be held on Thursday of next week to consider existing agreements. It is not probable that changes will be made in either lines and the structural agreement will certainly be renewed for another year.

While none of the officials of the Union Steel Co. will affirm or deny the report, it can be safely stated that plans are under consideration for the erection of a rail mill at either Sharon or Donora, Pa. Plans also provide for the erection of a structural mill.

PIG IRON.—While many of the foundries in this district have contracted for their iron far into next year, a large number have not covered beyond January 1. Thus far they have shown no disposition to come into the market and no doubt anticipate slightly better quotations within the next month or six weeks. While many of the furnaces are beginning to catch up on their deliveries the majority of them can be said to be fully two months behind and until these deliveries are nearly completed it is doubtful if the foundrymen will buy for forward delivery. Small lots of No. 2 foundry iron are being sold at $24.50 for immediate delivery and some of the furnaces are holding out for $23.50 for delivery the first half of next year. There is practically nothing doing in either basic or forge irons. Bessemer iron for prompt delivery is held at $24 at the Valley furnace and a few small lots were sold at ths price during the week. We revise quotations as follows:

Bessemer, Valley	$21 25 to 21 50
Bessemer, Pittsburg	21 75 to 22 25
No. 1 Foundry	24 00 to 24 50
No. 2 Foundry	23 00 to 23 50
Gray Forge, Pittsburg	20 75 to 21 00
Chilled Basic, Valley	21 00 to 21 50
Chilled Basic, Pittsburg	21 75 to 22 25

STEEL.—We note the sale of 10,000 tons of open-hearth billets for delivery the first six months of next year at $30.50 at the mill; also, the sale of 1,500 tons of Bessemer billets for delivery during the latter portion of this month, January and February, at $28.50 at the mill. Both Bessemer and open-hearth rods are quoted about $34.50 to $35 at the mill. There is practically no buying of foreign steel in this market, although considerable activity is reported in the East where deliveries can be made at $28 per ton.

FERRO-MANGANESE.—Manganese of English manufacture continues to be sold in this market at $50 per ton in 50 ton lots and over. Small lots for immediate shipment are held at $55 per ton delivered.

SPELTER.—There have been further declines in the spelter market during the week and prime Western grades are held at 4.85c to 4.88½c, Pittsburg, in carload lots. Smaller lots are held at an advance of about 35 cents per 100 pounds.

MUCK BAR.—Eastern manufacturers continue to sell muck iron in this market at $33.50 per ton. Local manufacturers are not attempting to compete and are refusing all orders where they are compelled to meet the quotations of the Eastern manufacturers.

SKELP.—There has been some buying of steel skelp during the week at prices ranging from 1.90c to 1.95c, for either grooved or sheared. Iron skelp is held at 1.85c to 1.90c.

RAILS AND TRACK MATERIAL.—Further concessions have been made by some of the mills rolling light rails and there is a slight falling off in the demand. We make the following quotations: Standard sections, 50 pounds and over, in lots of 200 tons and over, $28; car lots and less than 200 tons, $30; less than car lots, $32; light rails, 8 pounds, $43; 12 pounds, $42; 16 pounds, $40; 20 pounds, $39; 25 to 40 pounds, $37 to $38. Track materials: Spikes, 2.15c to 2.25c; track bolts, square heads, 2.05c; hexagon heads, 2.65c; fish plates, 1.60c.

PLATES.—A meeting of the plate manufacturers will be held in New York next week for the purpose of considering existing prices. That there will be no change in agreement quotations is certain. The general condition in the plate trade continue unchanged. For early shipment the mills are securing 1.85c per ton, while on large orders for future delivery agreement quotations maintain as follows: Tank plates, ¼-inch thick and up to 100 inches in width, 1.60c at mill, Pittsburg; flange and boiler steel, 1.75c; marine, ordinary fire-box, A. B. M. A. specifications, 1.80c; still bottom steel, 1.80c; locomotive fire-box, not less than 2.10c, and it ranges in price to 3c. Plate more than 100 inches wide, 5c extra 100 pounds. Plate 3-16 of an inch in thickness, $2 extra; gauges Nos. 7 and 8, $3 extra. These quotations are based on carload lots, with 5c extra a hundred pounds for less than carload lots. Terms, net cash, in 30 days.

BARS.—Agricultural implement manufacturers are not specifying very heavily at the present time and nearly all of the mills are in position to make prompt deliveries. Large tonnages will no doubt be ordered by the implement manufacturers after the first of the year. The large manufacturers of iron bars report that they are securing agreed prices, though common iron has been sold as low as 1.70c Pittsburg. We note the sale of one lot of 1,500 tons of iron at 1.85c, Pittsburg. We make the following quotations: Bessemer steel bars, 1.60c; open-hearth, 1.70c; plow beams and cultivator beams, 1.60c, net; channels, angles, zees and tees, Bessemer under 3 inches, 1.70c; over 3 inches, 1.80c; common bar iron, 1.70c to 1.80c, Pittsburg, with freight added to point of delivery. Hoops and bands are quoted at 1.90c, full extras, in 250-ton lots and over, and 2c in less than 250-ton lots; refined iron bars, 2c and upwards.

STRUCTURAL MATERIAL.—The amount of new business that the mills are booking continues heavy and none of the mills in this district can promise deliveries before July 1, next year. At Johnstown, Pa., the order for structural material for one of the new buildings that is being erected by the Lorain Steel Co. was placed with German mills as the proper delivery of the material required could not be secured from the American mills. We make the following quotations on large lots for forward delivery: Beams and channels, 3 to 15 inches, 1.60c; 18 to 24 inches, 1.70c; tees, 1.65c; zees, 1.60c; angles from 3 to 6 inches, 1.60c; universal mill plates, 1.60c.

PIPES AND TUBES.—Some of the independent manufacturers of merchant pipe are meeting with considerable difficulty in meeting the quotations of the National Tube Co., but despite the fact that there is little profit in the conversion of steel pipe unless there is a connected steel supply, some of the mills have made slight concessions to secure business. The amount that is being offered is large and greatly exceeds that placed during the same period last year. Quotations in carload lots, plus freight to destination, are as follows:

MERCHANT PIPE.

	Steel		Guaranteed Wrought Iron	
	Black. Percent.	Galv. Percent.	Black. Percent.	Galv. Percent.
⅛, ¼ and ⅜ inch	68	58	65	55
½ inch	70	60	67	57
¾ to 6 inch	75	65	72	62
7 to 12 inch	73	63	70	60
Plugged and Reamed				
1 to 4 inch	73	63	70	60
Cut 3 to 6 feet				
⅛, ¼ and ⅜ inch	63	52	60	49
½ inch	65	54	62	51
¾ to 6 inch	71	60	68	57
7 to 12 inch	69	57	65	54
Cut 6 feet and longer				
⅛, ¼ and ⅜ inch	64	53	61	50
½ inch	66	55	63	52
¾ to 6 inch	72	61	69	58
7 to 12 inch	70	58	66	55
Extra Strong Plain End				
⅛ to 8 inch	60	59	65	55

Threads only—Same as Plain End, plus 1¼ percent net.
Threads and Couplings—Same as Plain End, plus 2½ percent net.

Double Extra Strong Plain End				
½ to 8 inch	61	51	57	47

Threads only—Same as Plain End, plus 2 percent net.
Threads and Couplings—Same as Plain End, plus 3 percent net.

NOTE: Orders for less than carload will be charged at 12½ percent advance. Extra and Double Extra Strong Cut Lengths, lower random discounts by 10 percent net for 6 feet and longer, and 15 percent net for 3 to 6 feet.

BOILER TUBES.

Steel.

	Percent.
1 to 1½ inches	45
2¼ to 5 inches	62½
1¾ to 2¼ and 6 to 13 inches	52½

Iron.

	Percent.
1 to 1½ inches	36½
2¼ to 5 inches	45½
1¾ to 2¼ and 6 to 13 inches	35½

CASING.

	S. and S. Percent.
2 to 3 inches	58
3½ to 4 inches	60
4½ to 12½ inches	68

SHEETS.—There has been little improvement in the demand for black sheets during the past week and there is no indica-

tion that the situation will improve to any great extent until after the first of the year. The demand for the heavier gauges, however, continues very heavy. Our quotations on 500 bundle lots and over are as follows: No. 28, 2.75c; No. 27, 2.65c; No. 26, 2.55c; Nos. 22 and 24, 2.45c; Nos. 18 and 20, 2.35c; Nos. 14 and 16, 2.25c; Nos. 10 and 12, 2.10c to 2.15c. Galvanized: No. 16, 2.60c; No. 18, 2.85c; No. 26, 3.35c; No. 27, 3.60c; No. 28, 3.85c; No. 29, 4.35c; No. 30, 4.50c.

Merchant Steel.—The market in nearly all lines continues firm. In shafting the manufacturers are in position to make fairly prompt delivery which has been much decired by consumers during the past six months. We make the following quotations: Turned cold rolled and ground shafting, 47 off in carload lots and 42 percent off in less than carload lots; tire steel, 2.15c to 2.25c; spring steel, 2.25c to 2.35c; toe calk, 2.30c to 2.40c. The following differentials maintain: Less than 2,000 pounds of a size and not less than 1,000 pounds, 10 cents advance; less than 1,000 pounds of a size, 30 cents advance. Tool steel is quoted 7 cents and upwards, according to the grade.

Wire and Wire Nails.—Specifications on wire nail contracts are coming in more freely than for some time and there has been considerable buying for forward delivery during the past week. November prices on cut nails have been practically reaffirmed for the present month except that iron cut nails now take an advance of 15 cents over steel nails in the territory west of Buffalo. We make the following quotations: Wire nails, carload lots, f. o. b. cars, Pittsburg, $1.85 to $1.90; less than carload lots, $1.95 to $2; plain wire, carload lots, $1.75 to $1.80; less than carload lots, $1.85 to $1.90; barb wire, carload lots, $2.15 to $2.20; less than carload lots, $2.25 to $2.30; staples, carload lots, $2.05, and less than carload lots, $2.15. Galvanizing, 30 cents extra. Cut nails are quoted as follows: Carload lots, $2.05, and less than carload lots, $2.10 f. o. b. Pittsburg, plus freight to point of destination. Terms, 60 days, less 2 percent off in 10 days.

Old Material.—The market continues firm owing to the heavy buying of dealers who are short on the market and are now buying to fill their contracts. Railroads at present are releasing large tonnages of material while the tonnage of old rails next year promises to be very heavy. We make the following quotations, gross tons: Heavy melting stock, $22 to $22.50; low phosphorous melting stock, $24 to $24.50; steel rails, $21 to $21.25; rerolling rails, $22.50 to $23; No. 1 cast scrap, $19.50 to $20; borings and turnings, $11 to $11.50; busheling scrap, $16 to $16.50; old iron rails, $24.50 to $25.

Coke.—For the week ending Saturday, Nov. 29, the output of the upper Connellsville region amounted to 210,958 tons, a falling off of about 40,000 tons from the production of the previous week. There was also a heavy falling off in the production of the lower region during the week. Foundry coke for prompt shipment continues to be quoted at very high prices. We note sales of carload lots during the week at $7 per ton while contracts for next year's delivery continue to be made at $5. Furnace coke is held at $3.75 to $4 for forward delivery.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, Dec. 9.

There is a sharp contrast between the buying of crude and finished iron and steel in this market. Purchases of pig iron are of a desultory character, while for finished steel there is a healthy demand. The depression of values that has been quietly going on for the past month, is responsible in a great measure for the scarcity of pig iron orders, melters not caring to buy on a decline market and being encouraged in this view by sellers, many of whom are willing to see prices go lower. Foundrymen are showing more interest at the present time in iron for prompt delivery, the recent cold snap having brought forward a brisk demand. There has been good buying of structural steel during the week, leading producers reporting sales aggregating 10,000 tons, half of which was taken by railroads and car builders. Mills are sold six months ahead on shapes from 4 inches to 12 inches, but on heavy beams and light angles can give fairly prompt delivery. Plates continue strong, the local mill having sold its capacity to next June. There is a good movement in wire products, jobbers throughout the West laying in stocks in anticipation of the advance in freight rates, which goes into effect Jan. 1. Orders are being placed freely for spikes and bolts, and from the South has come a good demand for light rails. Electric roads are frequent inquirers for standard sections, but owing to the remote deliveries which are promised few of them develop into trades. The bar iron market is less erratic than it has been for several weeks. Mills are receiving specifications in fair volume, and while eager for new business, they are in a better condition at the present time to refuse orders that are offered at less than what they consider a profitable price.

Independent pipe and sheet mills are suffering in the distribution of orders for these products, many of them not being able to meet the quotations of the leading producers. The scrap market continues weak, demand for melting steel and for the material consumed by bar mills being extremely limited. Sales of 5,000 tons of foreign billets were made during the week, and several carloads of foreign pig iron that were on track were disposed of to a local producer at a good round price.

Pig Iron.—There are three well defined sets of prices ruling in this market for pig iron at the present time. The first is that for immediate shipment, or iron on track, which is offered at $26.65 for No. 1 foundry and soft, and $26.15 for No. 2 foundry and soft. The second is that for iron for delivery in January and February, which is sold at from 50 cents to $1 a ton less; the third basis of values is for iron for delivery from March to June, sales of which are being made at $19 to $20 at Southern furnace, though $19.50 for No. 2 foundry is the more common quotation. Sales outside these figures, however, have been made during the week, and to show the wide range in prices and the rapid shifting of the market, we report a few of them: one order for 1,500 tons of Nos. 1 and 2 soft, for immediate shipment, was placed at $25.15, Chicago; another order for 100 tons of No. 2 foundry, for December shipment, at $27.65, Chicago; an order for 100 tons of Southern No. 1 foundry, deliveries extending into the second half of 1903, was placed at $25.15 for the iron to be delivered in the second quarter, and $24.15 for that to be shipped in the second half; an order for 300 tons of Northern No. 2 foundry, for delivery during March, June and July, was closed at $25, delivered on consumer's track. Other sales have been made at variance both with the established quotations and with the present condition of the market, but as the conditions entering into most of them were of a special nature, they can hardly be said to represent the market. There has been a brisk demand during the week for spot iron, the recent cold snap having delayed shipments from furnaces. Southern producers are suffering from a scarcity of cars, and are reported to be accumulating large stocks in their yards. This will intensify the demand for spot iron, and retard the leveling process in values that has been going on and which sellers hoped would reach its bottom by the first of the year. Malleable foundries have been active buyers of Standard Bessemer during the week for prompt shipment, sales being made on the basis of $26 Chicago. Melters are evincing little disposition to buy either for the first or second half as a result of the efforts being made to depress the market. There is, however, a good volume of inquiries, and buyers only need the assurance that the market has reached its bottom for an active buying movement to set in. Unofficial announcement has been made by railroads that the freight rate from Southern points will be advanced 20 cents a ton the first of January, making the rate from Birmingham to Chicago, $4.35. The quotations given below are for iron for delivery in the second quarter of next year; for the last half, they may be shaded 50 cents to 75 cents a ton:

Lake Superior Charcoal	$26 00 to 27 00
Local Coke Foundry No. 1	23 50 to 24 00
Local Coke Foundry No. 2	23 00 to 23 50
Local Coke Foundry No. 3	22 50 to 23 00
Local Scotch Foundry No. 1	24 00 to 24 50
Local Scotch Foundry No. 2	23 50 to 24 00
Southern Coke No. 1	24 15 to 24 65
Southern Coke No. 2	23 65 to 24 15
Southern Coke No. 3	23 15 to 23 65
Southern Coke No. 4	22 65 to 23 15
Southern No. 1 soft	24 15 to 24 65
Southern No. 2 soft	23 65 to 24 15
Southern Gray Forge	22 15 to 22 65
Southern Silveries	26 65 to 27 15
Jackson Co. Silveries	31 00 to 32 00
Ohio Strong Softeners	26 10 to 27 10
Alabama Car Wheel	27 15 to 27 65
Malleable Bessemer	25 00 to 26 00

BARS.—The leading local producers of iron and steel bars report that specifications showed an improvement in the past week, and the volume of new business is expected to increase after the turn of the year. Owing to the large increases being made by railroads to their rolling stock, many supplementary orders are being placed by these and by car builders for bar iron, putting the mills in better shape than they have been for some time. The leading manufacturers of iron are showing more unanimity in the price of this product, and some are holding for 1.80c as the minimum at which they will take new business. On carload lots, the price ranges from 1.85c to 1.90c. Some sales have been reported at 1.70c and 1.75c, but the iron was generally below first quality, and considered in some cases of odd sizes and which mills had in stock. Tentative inquiries are being received by steel manufacturers for deliveries in the coming year, and some orders are expected to be closed this week. The demand for hoops and angles is greatly improved, particularly for the former, coopers and brewers sharing in the general prosperity. Renewed attempts have been made in the past two weeks to combine the independent bar iron mills in the West, but the effort has failed. We quote mill shipments, Chicago delivery, Bessemer steel, 1.75c to 1.85c; angles, less than 3x3, 1.85c to 1.95c base; iron, 1.80c to 1.85c; hoops, 2.15c. Prices on stock from store, steel, 2c to 2.10c; iron, 2.15c to 2.20c; hoops, 2.40c to 2.50c; angles, 2.50c to 2.60c.

SHEETS.—There is little demand for sheets, and prices fluctuate according to the size of the order and delivery required. We quote No. 27 black, mill shipment, Chicago delivery, 2.80c to 2.90c; galvanized, 3.75c to 3.85c; for delivery from stock, No. 27 black, 3c to 3.10c; galvanized, 75 percent to 75 and 5 percent.

STRUCTURAL STEEL.—Railroads and car builders have been active buyers in the past week, placing orders for about 5,000 tons of steel. Orders from other sources total about 4,000 tons. Contracts were let during the week for the structural shapes required in the Pope building, 1,200 tons, and for the Iroquois Theatre, 450 tons. The latter will come from stock. Mills report that they are sold up for nearly six months on all shapes from 4 inches to 12 inches, but they can give prompt deliveries on beams, 15 inches and over, and on angles, tees and channels, 3x3 and under. We quote mill prices, Chicago delivery, as follows: Beams, 15 inches and under, 1.75c to 1.85c; 18 inches and over, 1.85c to 2c; universal plates, 1.75c to 1.85c; angles, channels and tees, smaller than 3 inches, 1.85c to 2c base. In lots from store, we quote 2½ to 3½ cents a pound.

BILLETS.—Dealers in foreign steel report sales in the past week of 3,000 tons of basic Bessemer billets, at $27.50 Eastern seaboard, and 2,000 tons of Siemens-Martin billets, at $28.50 seaboard. Both lots were for deliveries to consumers in the East. Small sales of foreign forging billets have been made at $36 to $37 delivered, and domestic open-hearth billets at $38 to $40.

RAILS AND TRACK SUPPLIES.—Inquiries from electric roads for standard sections are numerous, though the percentage that result in orders is small owing to the inability of mills to promise delivery before next fall. The demand for light rails is brisk, particularly from the South, where track building operations are not interfered with by the weather. There is a brisk trade in spikes and bolts. We quote standard sections, $28; second quality, $27; light rails, 45 pounds, $34 to $35; 12 pounds, $40 to $41, with regular differentials for intermediate sizes, light rails out of store, $45 to $50. Track supplies, mill shipment, are quoted as follows: Angle bars, 2c to 2.10c; spikes, first quality, 2.25c; second quality, 2.15c; track bolts, 3½x¾, with square nuts, 2.85c to 3c per 100 pounds; with hexagon nuts, 3.05c to 3.15c, with usual differentials for other sizes.

MERCHANT STEEL.—New business is not on a large scale, mills not seeking it and not being in shape to handle any more than they already have on their books. Specifications are heavy. We quote mill shipments, Chicago delivery, as follows: Spring steel, 2.65c to 2.75c; sleigh shoe, 1.95c, flat sizes; concave and convex, 2c; out of store, 2.15c; cutter shoe, 2.50c to 2.60c; machinery steel, 2.15c to 2.25c, base; plow steel, 2.50c and upwards, according to quality; toe calk, 2.30c to 2.40c; out of stock, 3c to 3.10c; ordinary tool steel, 6c to 7c; specials, 13c and upwards; less than carload lots, 5 percent to 10 percent higher; cold rolled shafting, carload lots, 47 percent off, Chicago; less than carload lots, 42 percent off, Chicago.

MERCHANT PIPE AND BOILER TUBES.—There is keen competition between the independent manufacturers and the leading producer, and reports are current that some of the former are shading the latter's discounts. The open weather that prevailed prior to the latter part of last week brought forth a good tonnage, the material going into immediate consumption; but with the advent of snow and cold weather, buying has fallen off. Boiler tubes are without change. We quote f. o. b. Chicago:

MERCHANT PIPE, RANDOM LENGTHS.

	Black. Percent.	Galv. Percent.
⅛ to ⅜ in., inclusive	66½ net	56½ net
16 in.	68½ net	58½ net
¾ to 6 in., inclusive	73½ net	63½ net
7 to 12 in., inclusive	71½ net	61½ net

BOILER TUBES.

Steel.

	Percent.
1 to 1½ in.	43½
1¾ to 2½ in.	56
2¾ to 5 in.	61
6 to 13 in.	56

Iron.

	Percent.
1 to 1½ in.	38
1¾ to 2½ in.	36
2¾ to 5 in.	46
6 inches and larger	36

CAST IRON PIPE.—New business is of small proportions and is confined to the usual run of orders for lots for repairing purposes. We quote f. o. b. Chicago, 4-inch water pipe, $36.50; 6-inch, $35.50; 8-inch, and upwards, $34.50; gas pipe, $1 a ton higher.

PLATES.—There is a brisk demand, and orders aggregating 4,000 tons have been placed with the local producer. This mill has sold its capacity to June next. We quote mill shipments, Chicago delivery, tank steel, ¼ inch and heavier, 1.75c to 2.10c, base; flange steel, 1.85c to 2.20c. Prices from stock, tank steel, ¼ inch and heavier, 2.25c to 2.35c; 3-16, 2.35c to 2.45c; No. 8, 2.40c to 2.50c; flange steel, 2.50c to 2.60c.

WIRE PRODUCTS.—The advance in freight rates which will be made January 1, bringing them to the old basis, has stimulated an active buying. Jobbers all over the West are laying in stocks of material, particularly of open fencing and poultry netting, and mills are pushed to the utmost to keep pace with the demand. We quote prices to jobbers, carload lots, Chicago delivery, as follows: Smooth wire annealed, 1.90c; galvanized, 2.20c; painted barb wire, 2.30c; galvanized barb wire, 2.60c; wire nails, $2; cut nails, 2.20c; polished staples, 2.15c; galvanized samples, 2.45c. Prices to retailers are 5 cents higher than above quotations on carload orders, and 15 cents higher on less than carload orders.

COKE.—A considerable tonnage of Connellsville coke has been booked during the week for forward delivery at $5 to $5.25 at the ovens. Little is doing in Virginia coke, manufacturers not caring to sell at the present time. However, quotations are generally the same as those for Connellsville. For spot shipment, $10 to $12 is asked for both Virginia and Connellsville.

OLD MATERIAL.—The market shows no improvement, demand for both melting steel and material entering into bar mills having fallen off to almost nothing. Neither is there an urgent demand for cast scrap. Dealers generally believe that with the advent of snow and cold weather, decreasing the shipments from country merchants, prices may become a little more stationary. We have revised our quotations and quote gross tons as follows::

Old Iron Rails	$24 00 to 24 50
Old Steel Rails (mixed lengths)	18 00 to 18 50
Old Steel Rails (long lengths)	23 00 to 23 50
Relaying rails	31 50 to 32 00
Old wheels	22 50 to 23 00
Heavy melting steel	16 50 to 17 00
Mixed country steel	15 00 to 15 50

The following are selling prices per net ton:

No. 1 R. R. wrought	$19 50 to 20 00
No. 2 R. R. wrought	18 00 to 18 50
Shafting	19 50 to 20 00
Dealers' forge	16 00 to 16 50
No. 1 busheling	14 00 to 14 50
No. 1 Cast	16 50 to 17 00
Railway malleable	16 00 to 16 50
Country malleable	14 50 to 15 00
Iron axles	23 50 to 24 00
Steel axles	19 50 to 20 00
Cast borings	10 50 to 11 00
Wrought turnings	13 50 to 14 00
Iron axle turnings	14 50 to 15 00

Steel axle turnings	18 00 to 18 50
Stove plates	12 50 to 13 00
Old iron splice bars	21 00 to 21 50

Goff, Horner & Co., Ltd., Pittsburg, proprietors of the Muskingum Valley Steel Co., Zanesville, O., have appointed A. M. Crane & Co., Inc., The Rookery, Chicago, sole Western sales agents for the entire product of these mills. The plant consists of five mills, and has a capacity of 1,500 tons a month of sheet iron and steel, of gauges 14 to 30. Large stocks of black sheets, corrugated sheets, and one pass cold rolled sheets are carried at Zanesville, from which prompt delivery can be given. The company manufacture in addition to the foregoing, pickled and cold rolled sheets, high grade electrical, armature and transformer sheets, V crimped roofing, pressed standing seam roofing, roll cap roofing, self cap roll roofing, pressed brick siding, steel ceilings, etc.

CLEVELAND.

OFFICE OF *The Iron Trade Review*, 1064 ROSE BUILDING, Dec. 10.

The usual ante-holiday quiet prevails in the market and buyers are providing for immediate needs only. While some purchases can be made at lower figures, there is no real weakness or indication of any material change in the level of prices.

IRON ORE.—The loading of ore at Lake Superior ports is ended for the season. Boats are still being loaded at Escanaba and may be for a week or more. On account of the coal shortage in the Northwest, vessels will run as late as possible. Discussion as to the probable price of ore next year shows that there is some feeling outside of the United States Steel Corporation (whose position is not known), in favor of an advance of from 25 to 50 cents. Mine owners hold that for two years they have not had their share of the profits and that a moderate advance is justified. Very little ore which has not been sold has been brought down this season, it is stated, but it is conceded that the furnaces are well supplied and that the coke shortage, which has prevented furnaces running regularly, has also resulted in considerable ore being left on dock.

COKE.—While delivery was better for two weeks, it has been very slow this week. Independent companies, which must now be relied upon by the foundries, are taking care of their old customers and those who have been purchasing from the Frick Coke Co. are in a quandary as to when they will get their supply. The price for 1903 is $5 for Connellsville foundry coke at ovens.

PIG IRON.—Spot iron can be had at about $2 cheaper than at the high point. No. 2 Southern is selling at $24.20, Cleveland, and No. 1 Northern at $25.50 for immediate delivery. Foreign is selling at the following prices: German, $25.50; Scotch, $24.50 to $25.50; English No. 2, Middlesboro, $23.50 to $24. The sale of foreign iron is very slow. One of the most prominent selling firms of the country has stopped buying abroad and is content to run along on present contracts, which do not expire until next April. While the foreign iron has been welcomed as a substitute at a trying time and has answered the purpose fairly well, it is the general opinion that, except under very unusual conditions, it is not strong enough to compete with iron made from Lake Superior ores. If the Cleveland market be accepted in evidence, there will soon be a marked diminution of imports of iron. There is very little Northern gray forge in the market. The price is about $20 for Northern and $21.20 for Southern, Cleveland. There is still very little interest in the market for foundry iron for the second half of 1903. For that delivery prices are on a basis of $22.75, Cleveland, for No. 1 foundry and $21.75 for No. 2. The United States Steel Corporation is contracting for some iron for the second half on conversion deals with furnaces which it supplies with coke. The price paid is not known. We quote domestic iron as follows for shipment in the first half of 1903:

Bessemer	$21 75 to 22 25
No. 1 Strong Foundry	23 00 to 23 50
No. 2 Strong Foundry	22 50 to 23 00
No. 3 Foundry	21 75 to 22 25
Scotch No. 1	23 00 to 23 50
Scotch No. 2	22 50 to 23 00
Gray Forge, Valley	20 00 to 20 50
Lake Superior Charcoal	27 50 to 28 00

FINISHED MATERIAL.—The quotation of 1.80c, Pittsburg, for bar iron is not heard of now except from makers who are not anxious to sell. The selling price ordinarily is 1.70c, Pittsburg, and that price is said to have been shaded somewhat. The price of steel, 1.60c for Bessemer and 1.70c for open hearth, Pittsburg, is adhered to. Sales agents are active and have met with fair success in selling steel bars. Plates continue firm. Structural material is in fair demand. Deliveries are gradually getting better. There is no change in prices. The sheet market is more demoralized than it has been for several weeks. Cutting continues at a lively rate. The prices of the distributors of the product of the principal producer, are as follows: For 3-16-inch sheets and heavier, 2.10c to 2.15c, Cleveland. Mill sales of black sheets, Cleveland, to consumers: No. 24, 2.65c to 2.75c; No. 26, 2.75c to 2.85c; No. 27, 2.85c to 2.95c; and the following prices out of stock: No. 10, 2.35c to 2.50c; No. 12, 2.45c to 2.60c; No. 14, 2.50c to 2.60c; No. 16, 2.55c to 2.70c; Nos. 18-20, 2.75c to 2.90c; Nos. 22-24, 2.85c to 3c; Nos. 25-26, 2.95c to 3.10c; No. 27, 3.05c to 3.20c; No. 28, 3.15c to 3.30c. On galvanized sheets we quote mill sales in carload lots, Cleveland, as follows: Nos. 10 and 11, 2.60c to 2.75c; Nos. 12-14, 2.70c to 2.85c; Nos. 15-17, 2.80c to 2.95c; Nos. 18-21, 3c to 3.15c; Nos. 22-24, 3.30c to 3.45c; Nos. 25-26, 3.55c to 3.70c; No. 27, 3.80c to 3.95c; No. 28, 4.05c to 4.20c; No. 29, 4.45c to 4.60c; No. 30, 4.95c to 5.10c. Galvanized sheets out of stock are quoted 75 and 2½ off.

OLD MATERIAL.—The rolling mills are showing a determination to beat down prices. Dealers are standing pat and sales are at a minimum. Lower prices on mill supplies may be expected. There is a good demand for heavy steel, stove plate and wrought drillings and the price of each has advanced about 50 cents. Machine cast scrap is also in good demand. We quote Cleveland prices, all gross tons, as follows:

Old iron rails	$25 50 to 26 50
Old steel rails (over 6 feet)	22 00 to 23 00
Old steel rails (6 feet and under)	21 00 to 22 00
Old car wheels	20 00 to 21 00
No. 1 R. R. wrought scrap	20 00 to 21 00
Mill scrap	19 50 to 20 00
No. 1 machine cast scrap	21 00 to 21 50
Iron axles	29 00 to 30 00
Steel axles	28 00 to 29 00
Axle turnings	18 50 to 19 50
Wrought turnings (free from cast)	16 00 to 17 00
Cast borings	11 00 to 12 00
Uncut wrought iron boilers	12 00 to 13 00
Steel boiler plates	17 00 to 18 00
Grate bars	12 00 to 13 00
Pipes and flues (clean)	17 50 to 18 50
Tank iron	17 00 to 18 00
Hoop and band iron	13 50 to 14 50
Sheet iron	12 00 to 13 00
Wrought drillings	15 50 to 16 50
Malleable iron (railroad)	20 50 to 21 50
Malleable iron (agricultural)	17 50 to 18 00
Stove plate	15 50 to 16 50
Heavy steel	19 00 to 20 00

CINCINNATI.

Dec. 9.

It has been an uneventful week. The coke market continues firm and spot coke is bringing strong figures. Quotations for spot and quick shipment foundry coke range from $6.50 to $7.50 per ton at ovens. For next year's delivery, the coke companies are not free sellers and $5 is the minimum figure. Pig iron prices are not materially changed and finished material is steady. Old material is firm with a good demand.

PIG IRON.—The majority of orders the past week have been for spot iron or quick delivery. Buyers are still holding off and practically no business is done for future shipment. Consumers are only buying enough to cover present needs, but the aggregate of these small spot orders is sufficient to absorb the offerings of the better grades, and there does not appear to be any further tendency to shade prices. The lower grades are still slow and easy but not quotably lower. The most interesting feature now is the future of the market. It is difficult to tell to what extent buyers have provided for their wants for the first half of 1903. It is estimated that for January, February and March a good majority of the consumers in this territory are fairly well covered. For April, May and June, perhaps less than half of the buyers are provided with contracts. This is the situation as reported by traveling men. At the same time it is reported that yard stocks at consumers' plants are very low and iron is being used right from cars. The recent decline in prices has curtailed the demand for foreign irons, and as the demand from this country has fallen off, German and English makers are pressing for fresh American orders quite urgently. To what extent the foreign iron will be bought or how attractive the price will be made remains to be seen. It is possible that domestic pig iron manufacturers will make prices

that will enable them to retain the home market. In this territory we have nothing of offerings of foreign iron as yet. For the latter portion of the first half of next year No. 2 foundry is still available at $19, Birmingham. For the second half $18 is the quotation, although both these prices are now but little more than nominal. The current business in spot and quick shipment iron is not large, but the demand is good enough to relieve the trade of any feeling of depression which would be felt if a decided dullness or a lack of interest were in evidence. The fact that buyers are alert and keeping posted, is evidence that consumption is not falling off and it is this feature of the situation which encourages steadiness, in the face of buyers pursuing a waiting policy. We quote for quick delivery f. o. b. Cincinnatti:

Southern Foundry No. 1	$23 25 to 23 75
Southern Foundry No. 2	22 25 to 23 25
Southern Foundry No. 3	21 75 to 22 25
Southern Foundry No. 4	19 25 to 20 00
Southern Foundry No. 1, soft	23 25 to 23 75
Southern Foundry No. 2, soft	22 25 to 23 25
Gray Forge	18 75 to 19 25
Northern Foundry No. 1	26 10 to 26 60
Northern Foundry No. 2	25 10 to 25 60
Southern car wheel iron	28 25 to 29 25
Malleable coke iron	25 00 to 25 75

FINISHED MATERIAL.—There is a fair demand for small lots and trade at iron stores is good. Buyers are taking only conservative quantities, which is usual at this season of the year; still in the aggregate there is a fairly good trade. Prices remain steady and unchanged. We quote black sheets No. 27 at 2.75c in car lots of 500 bundles. Black sheets out of store are selling as follows: No. 28, 3.20c; No. 27, 3.10c; No. 16, 2.75c; No. 14, 2.65c; No. 12, 2.55c; No. 10, 2.45c. Galvanized sheets car lots sell at 75 and 10 percent off; less than car lots, 70 and 10 percent off. Tank plates out of store are quoted at 2.25c for ¼-inch and 2.35c for 3-16-inch. Prices for bar iron in carload lots are: 1.80c base, half extras f. o. b. Cincinnati; steel bars, 1.72c base, half extras f. o. b. Cincinnati. Both are retailed at 2c base, half extras, out of store. Beams and channels are selling 2¼ to 2¾c, retail, and angles at 2.15c to 2.25c for base sizes. Merchant pipe and boiler tubes are quoted as follows for carload lots f. o. b. Cincinnati:

MERCHANT PIPE.

(Basing discounts.)

	Steel Pipe. Black. Percent.	Steel Pipe. Galv. Percent.	Guaranteed Wrought Iron Pipe. Black. Percent.	Guaranteed Wrought Iron Pipe. Galv. Percent.
⅛, ¼, ⅜-inch	66.8	56.8	63.8	53.8
½-inch	68.8	58.8	65.8	55.8
¾ to 6-inch, inclusive	73.8	63.8	70.8	60.8
7 to 12-inch, inclusive	71.8	61.8	68.8	58.8

BOILER TUBES.

	Steel Percent.	Iron Percent.
1 to 1½ in	43.8 & 5	38.8 & 5
1¼ to 2½ in	56.3 & 5	36.3 & 5
2¾ to 5 in	61.3 & 5	46.3 & 5
6 to 12 in	56.3 & 5	36.3 & 5

OLD MATERIAL.—The demand is fairly active and quotations are well maintained. We quote:

Old No. 1 Wrought Railroad, net tons	$19 50 to 20 00
Cast Machine and Foundry, net tons	18 50 to 19 00
Old Iron Rails, gross tons	24 00 to 24 50
Old Steel Rails, gross tons	22 00 to 23 00
Old Short Lengths, gross tons	18 50 to 19 00
Old Iron Axles, net tons	25 50 to 26 00
Old Chilled Car Wheels, gross tons	22 50 to 23 00
Stove Plate, net tons	11 50 to 12 00
Wrought Turnings, net tons	14 50 to 15 00
Cast Borings, net tons	12 00 to 12 50

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM 1909, NO. 150 NASSAU ST., Dec. 9.

PIG IRON.—Developments in the pig iron market in this vicinity during the past week were chiefly confined to foreign irons. In our previous letter, we stated that Middlesboro No. 3 could easily be had in large lots by good customers at $18.50, if not a shade lower. During the past week, however, prices sagged considerably, and at this writing this grade can easily be had at $18 in large lots, New York delivery, duty paid. One representative of a large foreign interest here quotes it at $17.75, which is the lowest that has been noted during the present year. Other brands of foreign irons have eased in values also. A week ago a serviceable grade of German irons could be had at $21, large lots, New York delivery, duty paid, but this same grade now rules at $20. In Scotch irons, prices are easier also. Ordinary grades, quoted a week ago at $21, can now be had at about $20.50. The recession in prices is attributed to decreased demand on one hand, and better freight rates on the other. Of the two reasons named, the latter is the more strongly emphasized. All along a disturbing factor in the foreign pig iron situation has been the probable freight rates the new Morgan shipping combine would levy. So many reports in this direction have been published recently, and they have been of such a conflicting character, that one foreign interest here addressed a letter to President Griscoin on the subject, who replied, stating, among other things: "It is not our aim to advance average freight charges. Through the magnitude and diffusion of our business, we can guarantee a reasonable stability of rates. Such stability is an invitation to capital. We can assure exporters that they can prosecute their plans for the extension of their business abroad, with reasonable certainty as to the part which transportation will play in the development of their plans."

The assurances given have had a salutary effect on foreign furnaces, which are now more disposed to book orders for 1903 than they have ever been. Many of them report more inquiries for the first half of the new year than they have had to date.

The situation in domestic iron has undergone no change. The transactions consummated nowadays are mostly due to be lated deliveries on old contracts. Foundrymen are buying to meet urgent needs not filled by contract.

Deliveries, on the whole, on old contracts are improving. The Southern furnaces are doing exceptionally well in this respect. The Sloss-Sheffield Company has its seven furnaces in operation now, and is enabled to make considerable headway with deliveries on old orders. Northern furnaces, which were compelled to bank recently in consequence of the scarcity of fuel, are gradually being blown in again, and this fact, together with the railroads being enabled to relieve the freight congestion considerably, has been responsible for more iron being delivered on old contracts than for some time past. For forward delivery all business being done is confined to the first half of the new year. Southern furnaces are weakening in the price they are asking for No. 2 foundry, for delivery the last half of next year. Instead of it selling at $20 at the furnace, which was the price many of the sellers originally agreed upon, sales are being made at $18.50, but generally in small quantities, as very few seem anxious to contract now for such a remote period. As a whole, the pig iron situation here is quiet, with expectations that it will continue to be so at least for the present month. A noteworthy fact is that sales agents, while strongly advising their customers to make provision now for their requirements for the first half of next year, dissuade them from doing anything far beyond it. New York prices for 1903 are as follows: No. 1 X Northern, $23.25 to $24.75; No. 2 X, $22 to $22.75; No. 2 plain, $21 to $21.75; Southern No. 1 foundry, $23.25 to $23.50; No. 2 foundry, $22.25 to $22.50; No. 3 foundry, $21.50 to $22; No. 4 foundry, $20.50 to $21.50.

BILLETS.—The market for German steel billets is without change. Prices continue $26.50, New York delivery, duty paid, for large lots, while smaller lots are quoted at about $27.

FINISHED IRON AND STEEL.—The general market for finished material continues to be excellent. The American Bridge Company, during the week, booked the following orders: for the Fifth National Bank, Pittsburg, 5,000 tons; for an armory at Buffalo, N. Y., 1,500 tons; and for several small bridges which a railroad in the Pittsburg District is building, 500 tons. This company, which heretofore has done an immense business in this locality, now notes building operations to be on an increasing scale in other localities, particularly east of the Mississippi and in the New England States. The rush in the plate business continues unchanged. The tone of the sheet market is better, particularly in black sheets, while galvanized sheets are a little easier. The bar iron situation is without special feature. New York prices are as follows: Beams and channels, 15 inches and under, 1.75c to 1.90c; angles, 3 to 6 inches, 1.75c to 1.90c; zees, 1.75c to 1.95c; bulb angles, 2.05c to 2.35c; deck beams, 2.05c to 2.25c; sheared steel plates, tank, 2.10c to 2.15c; flange, 2.25c to 2.30c; fire box, 2.30c to 2.50c; refined iron bars, 1.95c to 2c; soft steel bars, 1.95c to 2.10c; steel sheets, in carloads, New York, No. 28, black, 3.05c to 3.15c; galvanized, 75 and 7½ off.

PHILADELPHIA.

Dec. 9.

Old orders are pretty well filled and new business is not as brisk as might be wished. Deliveries are being made more promptly and mills are able to meet all demands. With money scarce abroad and labor conditions unfavorable both in England and on the Continent, it seems certain that the foreigners will not give up the American trade without a struggle to maintain it. It is expected that there will be large shipments from abroad for at least several months.

PIG IRON.—Consumers are afraid to risk the hand to mouth or day to day purchase plan, but they are unwilling to buy heavily at present high prices, especially when there is a chance to get foreign iron at any time. Hence the market is dull and unsettled. There is talk of heavy purchases after Jan. 1, but no one can predict with certainty that they will be made. It seems probable that buying will not be extensive until the outlook becomes clearer. Prices of foreign iron are weak, delivery price of Middlesboro being about $18.50 and $19.50 and $20.50 for Scotch and German. Small lots are delivered at from $21 to $24. American brands as follows: No. 1 X foundry, $25 to $26; No. 2 X foundry, $23 to $24; No. 2 plain, $22.25 to $22.75; gray forge, $21 to $21.50.

BILLETS.—Few sales are being made. Imports are heavy, the price being $26.50 to $27, c. i. f., duty paid.

FINISHED MATERIAL.—Demand is light except for plates. Orders for iron bars are few, but still bars are firm at old prices and demand fair. Structural material is very dull and good deliveries can be had without paying premiums. We quote as follows: Plates, small lots, 2.10c to 2.15c; carload lots, ¼-inch and thicker, 2c to 2.05c; universals, 2c to 2.05c; flanges, 2.10c to 2.20c; fire box, 2.25c to 2.30c; marine, 2.30c to 2.35c. Steel bars are 1.80c to 1.85c, prompt shipments from local mills; Western steel, 1.75c to 1.80c. Bar iron is sold at 1.92c to 1.95c for carload lots. Next year's deliveries of structural steel are quoted at 1.72c to 1.80c, but for prompt shipments large sizes will command from 1.90c to 2.10c.

OLD MATERIAL.—Arrivals of scrap from abroad keep prices in check. We quote as follows:

Old steel rails	$20 50 to 21 50
Miscellaneous heavy steel scrap	20 00 to 20 50
Low phosphorus scrap	27 00 to 28 00
Old steel axles	25 00 to 26 00
Old iron axles	28 50 to 30 00
Old iron rails	24 00 to 24 50
Old car wheels	20 00 to 21 00
Choice scrap R. R. No. 1 wrought	22 00 to 23 00
Country scrap	20 00 to 21 00
Machinery cast	19 50 to 20 50
No. 2 light scrap (forge)	17 00 to 17 50
No. 2 light scrap (ordinary)	14 00 to 15 00

The Metal Market.

NEW YORK.

OFFICE OF *The Iron Trade Review*,
ROOM NO. 150 NASSAU ST., Dec. 9.

PIG TIN.—Prices have declined within a week from 20 to 45 points. As has been the case for several weeks past the market is in the hands of manipulators, who encounter no opposition in carrying out their plans, and who are favored by several adverse conditions, the most notable being a slackening demand, especially from tin plate manufacturers. In London, the market declined considerably during the week, due not only to decreased demand, but to stocks accumulating so rapidly as to almost mark the total disappearance of premiums. Today's closings at the Metal Exchange were as follows: Spot, 24.80c; December, 24.75c; January, 24.75c. London's closings today follow: Spot, £112 17s 6d; futures, £112 15s. Arrivals at Atlantic ports to date aggregate 642 tons, with 2,270 tons afloat.

COPPER.—The feature in the copper situation during the week was the attempt made in London to advance prices, which sent spot up as high as £51 12s 6d. Under heavy offerings, however, the market receded, closing today 12s 6d lower than the highest price reached. The bullish sentiment in London did not affect this market, and prices have been, and are now, about the same as those which prevailed a week ago. Consumers are out of the market, and not a sale took place on the Metal Exchange during the week, thus making the prices of the nominal order. Such outside buying as is going on is confined to small quantities to meet existing requirements, with the buying for extended delivery at a standstill. There are rumors of a consolidation of leading interests, but no definite developments can be noted. Today's closings at the Metal Exchange were as follows: Lake, 11.65c nominal; electrolytic and casting, 11.45c, nominal; standard, 10.75c nominal. London's closings today follow: Spot, £51; futures, £51 7s 6d. Exports to date amount to 3,900 tons.

PIG LEAD.—Lots of 50 tons or more are unchanged at 4.12½c. The St. Louis market continues steady at 4c. London is stronger today by 1s 3d than a week ago, being now quoted at £10 13s 9d. Favorable reports of an early consolidation of prominent companies continue. St. Louis, the market declined to 4.60c on free offerings. London, after declining 2s 6d on Thursday, closed today at £19 17s 6d, the price it was a week ago.

ANTIMONY.—Cookson's, which has been selling for months past at 9 and 9½c, sold in small quantities during the week at 8½c, to be circulated, but in well informed circles no credence is placed in them.

SPELTER.—The market has been weak and lower, spot being easily obtainable at 4.95c. The weakness is ascribed to decreased demand from manufacturing sources. December to January declined 10 points, and is now 4.85c. It is now offered at 8¾c. Hallet's and other brands are unchanged at 7¼ and 7½c.

NICKEL.—Unchanged. Prices average 40c to 60c, according to quantity.

QUICKSILVER.—Jobbers only are in the market, and sales have been made on the basis of $48 per flask in lots of 100 flasks. London, £8 15s.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
519 MONADNOCK BLOCK, Dec. 9.

The market continues to be an inactive one. Buying is limited to such small lots as will tide consumers over the holidays. Few concerns care to carry stocks at this time of the year, the time of taking inventory being too near at hand. The price of metals has suffered during the week as a result of the stock-jobbing operations of the New York market and the conditions enumerated. The price of copper has advanced, but sheet zinc has declined. We quote jobbers' prices, as follows:

Lake copper, carload lots, 11¾c; less than carload lots, 12c to 12¼c. Pig tin, 26¼c; pig lead, carload lots, 4.05c to 4.07½c; less than carload lots, 4.10c. Sheet zinc, carload lots, 6¼c, and 6⅜c in lots of 600 pounds. Spelter, carload lots, 5.25c; less than carload lots, 5¾c to 6c. Antimony, 10¾c to 11c for Cookson's, and 9¾c for Hallett's in small quantities. Nickel, 50c to 60c, according to size of order and delivery. Demand for old metals is light, and prices irregular. Selling prices of dealers are as follows: Copper wire, $10.25; heavy copper, $10.25; light copper, $9.25; red brass, $10.25; yellow brass, $7.75; light brass, $6.50; lead pipe, $3.90; zinc, $3.75.

Some Unique Ideas in Co-Operative Industry.

The Sterling Wrench & Tool Co., Dixon, Ill., is building a foundry for making malleable iron as well as steel castings. The company is incorporated with a capital stock of $250,000. The stock is placed on sale at a regular monthly payment of one percent. The work has been under way for the past three months; the first building, a brick structure, 150x50 feet is about ready for the roof. The promoter of this company, E. T. Warn, an experienced mechanic and an inventor of several specialties in tools, has introduced in his incorporation papers the following article: "A scale of wages shall be paid at all times equal to those demanded by union labor and as much more as it is possible to pay consistent with the welfare of the concern, while using due diligence to continue business without cramping the company for funds." Another feature of this company is the manner of making payments for labor performed. A time check is given each evening to each workman, this check being good at the bank, and a man can cash his time checks at any time he chooses. Mr. Warn has just filed incorporation papers for a company with authorized capital of ten million dollars and expects to build a city on the cooperative plan. This company will be known as the Laborers' Industrial Development Co.

THE IRON TRADE REVIEW

Devoted to the Machinery, Metal-Working and Foundry Trades, and Iron and Steel Manufacture.

PUBLISHED EVERY THURSDAY BY

THE IRON & STEEL PRESS CO.,

ROSE BUILDING, CLEVELAND, OHIO.

G. H. GARDNER, President and Treasurer,
JOHN A. PENTON, Vice-President,
A. I. FINDLEY, Secretary.

A. I. FINDLEY, - - - - - - - - EDITOR.
ROBERT I. CLEGG, - - EDITOR MACHINERY DEPARTMENT.
GEORGE SMART, - - - - ASSOCIATE EDITOR.

CHICAGO: 519 Monadnock Block, GEO. H. GRIFFITHS, Manager.
PITTSBURG: 429 Park Building, A. O. BACKERT, Manager.
NEW YORK: 150 Nassau St., D. C. WARREN, Manager.
THE CENTRAL WEST: R. A. EVANS, Manager.

Subscription, $3.00 per annum. To Foreign Countries, $4.00.
Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

DECEMBER 11, 1902

PHASES OF THE TIN PLATE SITUATION.

Some time ago we presented details showing the great excess of capacity in the United States for the production of tin plates over any possible domestic demand. It is interesting to note now how the mills are running. From careful inquiry we find that there are in the United States at the present time 350 tin mills completed and in regular operative condition. Of the independent mills we include in this total only those which are completed and are regarded as being ready to execute orders. Of the American Tin Plate Co.'s mills we do not include those which have been abandoned as to their present location, although it is not to be considered that such mills are abandoned permanently. As with mills of the company formerly abandoned, they are likely to be set up and operated in some new location. For the present, however, we exclude them from the figures. This gives 96 independent mills and 254 tin plate company mills, or a total of 350 mills.

From careful inquiry we find that at the present time there are in operation, out of the total of 350 mills, 166 mills, or 47.4 percent. This total is made up of 52 independent tin mills and 114 tin plate company mills. The proportion of independent mills in operation is greater than of tin plate company mills, but this is due to the fact that the tin mills owned by stamping companies, and thus having a market direct, are in practically full operation.

Interesting deductions may be made by noting the number of operative and idle mills which are run under Amalgamated Association auspices. We find that the independent mills which have signed the scale amount to 43 out of the 96, while the American Tin Plate Company has signed the scale for 180 out of 254 mills. The operating mills are made up as follows:

	Union.	Non-union.	Total.
American Tin Plate Co.....	74	40	114
Independent	22	30	52
	96	70	166

Thus the American Tin Plate Co. is operating considerably more union than non-union mills, while with the independents the reverse is the case. These figures upset a popular belief that the "trust" has been operating non-union mills almost exclusively, while it indicates on the other hand that the independent mills which have signed the scale are suffering much more severely than those which run under non-union auspices. We refrain from discussing this latter phase of the matter.

The present month is always the dullest season of the year in the tin plate trade. In the old days of independent competition and gradual price reduction as profits decreased and methods of manufacture were improved, it was always towards the close of the year that the greatest strides towards lower prices were made. From the beginning of 1895 to the middle of 1898 prices dropped with scarcely a reaction, and the monthly course of the market showed a good decline towards the close of each year, followed by a stationary or only slightly declining market. This behavior of the market was always explainable by the fact that mills, generally not very strong financially, were hard pressed to get specifications for December, and accordingly named lower prices, which incidentally the buyers, who were strong financially, made to cover a period of several months, the mills thus conceding a lower price for several months in order to get specifications for one month.

It is interesting therefore to note the approximate production of the mills in operation. Under modern methods outputs are much larger than formerly, and it may be assumed safely that the mills now in operation represent a weekly output, with some allowance for accidents, of fully 40 tons each. Mills which can run now ought to be able to make 50 weeks in the year, which would indicate an annual production of 332,000 tons. Our heaviest domestic production was 400,000 tons, in 1901.

Clearly the margin for more mills starting in operation is not very large, so far as domestic trade is concerned. As for the export trade, the absurd limitation placed on the quantity by the Amalgamated Association substantially permits the American Tin Plate Co. to run one mill on such business for every 7 1-3 mills run on domestic business. Thus the 74 union mills operated by the company afford the opportunity to run but 10 mills on export business. Should the company desire to capture any large part of the export business it would have to arrange for concessions from non-union workers as well.

It is the general admission in the tin plate trade that the new price for tin plate does not permit any profit with the present market price of steel, but in fact involves an absolute loss. We know of one independent company whose board of directors formally passed a resolution to continue manufacturing provided the loss did not exceed a certain amount per ton. The presumption is that independent mills now running are working up steel bought at lower than the present market. Such a condition is known to exist in the sheet trade, where certain mills are working steel into stock—mainly stovepipe gauges—because the steel must be specified by the end of the year or the contract lapses, such contracts being around $24 a ton for billets.

It may not be known outside the immediate tin plate trade that the present quotation of the American Tin Plate Co. is on an entirely different basis from previous

quotations. Until last month the company made a practice of forecasting how long the market would with reasonable certainty maintain a certain figure, and then quoted its price covering such a period. The price was not guaranteed arbitrarily, but the guarantee went with it that the company, with its various sources of information, expected that the price would rule. In recent months independent concerns have sailed with the tin plate company's wind, cutting prices where the company could not. The new price of $3.60 named early last month was on the same basis that any manufacturer would quote: subject to immediate acceptance, and for shipments any reasonable distance ahead which the buyer in his own judgment chose to take. It is subject to withdrawal at any time. The independents are thus forced to stand on their own feet.

IRON AND STEEL IMPORTS AND EXPORTS—A TURN.

The report of the Treasury Department for October and for the ten months ending with October shows that the imports of pig iron, which steadily increased from 7,633 tons in January to 82,196 tons in September, have probably struck the top notch, for in October only 67,204 tons, or 14,995 tons less than for September were brought to our shores. The imports of steel show an increase over September of 4,310 tons but a decrease of 6,991 tons as compared with August. The following table shows the pig iron and steel imports since Jan. 1. The column of steel includes ingots, blooms, slabs, billets and bars of steel and steel "not elsewhere specified," structural steel being thus included:

IMPORTS OF PIG IRON AND STEEL—GROSS TONS.

	Pig Iron.	Steel.
January	7,633	5,312
February	8,007	2,235
March	18,184	6,570
April	19,067	13,005
May	30,508	24,388
June	32,258	35,588
July	62,106	36,124
August	79,447	39,027
September	82,196	27,726
October	67,204	32,036
	406,610	222,011

The imports of hoops have fallen to 9 tons, as compared with 1,153 tons in October, 1901, and 117 tons last September. A marked change is found in the figures as to tin and terne plates. While in October, 1901, there were imported 9,277 tons and in September, 1902, the imports were 4,396 tons, they fell to 306 tons in October, 1902. The importing of wire and wire articles has increased as compared with September, 1902, when the total was 154 tons, but has decreased from 973 tons in October, 1901, to 356 tons in October, 1902. The following table gives in detail the imports for October and for the ten months ending with October:

IMPORTS OF IRON AND STEEL TO THE UNITED STATES—GROSS TONS.

	October.		Ten months, ending October.	
	1901	1902	1901	1902
Pig iron	5,371	67,204	39,336	406,610
Scrap	1,452	11,371	16,454	36,859
Bar iron	2,770	1,906	17,068	23,030
Iron and steel rails	195	14,365	1,085	49,388
Hoop, band or scroll	1,153	9	2,841	3,193
Steel ingots, slabs, billets or bars	850	32,036	6,603	222,011
Sheets and plates	725	437	4,321	5,163
Tin and terne plates	9,277	306	59,920	47,177
Wire rods	1,612	2,584	14,385	16,692
Wire and wire articles	973	356	3,361	2,802
Total	24,378	130,574	165,364	860,801

The total value of iron and steel imports for October, not including ore, was $4,148,819 against $2,291,061 for October, 1901. For ten months the total was $31,987,056 against $16,349,427 to the end of October, 1901. Iron ore imports in October were 102,294 tons against 82,871 in October, 1901, and for ten months, 997,561 against 807,547 in 1901.

Exports for October were 6,611 tons more than for September and 17,662 less than for October, 1901. For the ten months the values were: for 1902, $81,977,545; for 1901, $85,911,774. For October, the total was $8,625,529 against $9,064,875 for October, 1901. The following table shows exports in detail:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES—GROSS TONS.

	October.		Ten months, ending October.	
	1901	1902	1901	1902
Pig iron	8,815	1,073	57,804	24,574
Scrap	1,880	404	12,551	8,182
Bar iron	530	234	16,465	18,953
Wire rods	1,620	2,999	6,008	18,245
Steel bars	1,029	598	22,648	8,243
Billets, ingots or blooms	93	125	27,196	2,189
Hoop, band or scroll	17	75	1,032	1,470
Iron rails	89	...	901	210
Steel rails	18,657	2,195	285,380	65,266
Iron sheets and plates	299	257	6,080	3,117
Steel sheets and plates	856	626	22,164	12,303
Tin plate, terne plate and taggers tin	11	53	427	1,427
Structural material	3,335	3,813	44,267	49,783
Wire	8,852	12,071	70,477	84,076
Cut nails	332	580	8,361	6,080
Wire nails	1,175	2,947	16,533	22,345
Other nails including tacks	178	156	1,575	1,544
Total	45,868	28,206	597,737	329,996

On the whole, while there is no great change, the report for October is more favorable for the United States and shows a tendency in the right direction. Imports have decreased 16,008 tons and exports have increased 6,611 tons.

GOVERNMENT BY UNION INJUNCTION.

Injunctions by courts, to restrain labor unions from interfering with a proprietor in the operation of his shop or with a workman in working where and as he chooses, came in for the usual warmth of denunciation at the recent Federation of Labor convention at New Orleans. The antipathy of certain trades unions to the courts that essay to curb the exercise of union power, seems to have its spring in union jealousy of the judiciary. The unions want a monoply of the injunction industry. When the union decrees idleness for a plant, owners, courts, and free workmen must obey the mandate. To the non-union worker the penalty of violation of the union injunction is serious bodily injury or, as often happens, death by violence, while to his family the result of his disobedience of union government by injunction is ostracism, bodily injury and persecution, even to the cutting off of sources of food and medicine. For the proprietor who refuses to heed the injunction, the union penalty is the boycott, the destruction of property and business, not infrequently violence. Upon the court that dares oppose the lawless union injunction by issuing an injunction based upon the statutes and constitution of the State, the union heaps contempt, with the result that the administration of justice is brought into low esteem with all whom the union influences.

When the right of a man to sell his labor is thus openly denied and the prerogative of the union to suspend the operation of Constitutional guarantees is affirmed, we have reached a point startlingly close to anarchy. Yet to this end has government by trade union injunction brought us in its malevolent assault upon the judiciary. Are we to look for a boycott upon the courts, after the fashion of the boycott now operative against the militia?

PERSONAL.

At the last meeting of the board of directors of the Allis-Chalmers Co., the office of consulting engineer for all the works of this corporation was created, and Edwin Reynolds, so long and favorably known in connection with the Edward P. Allis Co., of Milwaukee, was promoted to that office. Irving H. Reynolds succeeds him as chief engineer, and Philetus W. Gates was elected third vice president and appointed general superintendent. Joseph H. Seaman, formerly third vice president, was made fourth vice president and secretary, and J. W. Young, the former secretary manager of the London office. Irving H. Reynolds still retains the position of superintendent of the Milwaukee works, and E. N. Dickson is office manager of the Milwaukee works. Arthur Niedermeyer is superintendent of the Chicago and Scranton works.

Wm. F. Donovan, of the Troy Steel Process Co., successor to the Troy Steel Co., will sail shortly for Europe. Plans for the improvements contemplated at Troy will be developed on his return.

W. D. Sargent, president of the American Brake Shoe & Foundry Co., is in Europe.

J. W. Duntley, president of the Chicago Pneumatic Tool Co., returned from England this week.

C. S. Powell, of Cleveland, representing the Westinghouse Electric & Mfg. Co., recently sailed for Europe.

After a continuous application of thirty-five years to business in Bay City, Mich., J. D. MacKinnon, president and general manager of the MacKinnon Mfg. Co., has decided to retire and has turned over his interests to the other stockholders of this company. Mr. MacKinnon was one of the founders and stockholders of the Variety Iron Works Cleveland. In 1867 he severed his connection with that company and located in Bay City, starting in a small way, in the boiler and iron working business. From year to year the works have grown, adding new departments from time to time, until today it is one of the leading concerns in that State in its line. The affairs of this company will now be in the hands of H. B. MacKinnon as president and general manager; A. C. MacKinnon as vice president and general superintendent, and D. P. Lewis as secretary and treasurer.

William E. Householder has been appointed night superintendent of the Demmler plant of the American Tin Plate Co., McKeesport, Pa. He succeeds D. Pitcock who has been appointed superintendent of the plant.

H. W. Harrison has resigned the presidency of the Harrison Machine Works, of Belleville, Ill., and has been succeeded by Cyrus Thompson.

John G. A. Leishman, formerly president of the Carnegie Steel Co., but now United States Minister to Turkey, spent several days in Pittsburg last week.

Thomas O'Connor Jones, superintendent of the Soho plant of the Jones & Laughlin Steel Co., Pittsburg, has been appointed assistant general manager of the South Side plants of the company. William Larimer Jones is manager of these works.

Blast furnace "K" of the Edgar Thomson plant of the Carnegie Steel Co., Braddock, Pa., was blown in last week, Miss Louise Morrison, daughter of Thomas Morrison, general manager of the plant, applying the torch. This furnace was built entirely under the supervision of the engineers at this plant and it was erected in record breaking time.

Herbert Thickett, who has been superintendent of the plant of the American Steel Castings Co. at Sharon, Pa., has been transferred to Pittsburg, where he will have charge of the company's sales department.

Mr. E. D. Frohman, secretary of the S. Obermayer Co., of Cincinnati, O., dealer in foundry supplies, and who has had charge of the company's warehouse at Pittsburg and the facing mills at Larimer, Pa., has been appointed assistant to the general manager of the S. Obermayer Co., with headquarters at Cincinnati.

Thos. F. Griffin, of Corrigan, McKinney & Co., Cleveland, started Monday for San Antonio, Tex., seeking a milder climate on account of the condition of his health. He was accompanied by Mrs. Griffin and Price McKinney.

The Oliver Mining Co. has made a gift of $3,000 to the gymnasium fund of the Michigan College of Mines.

LAKE SUPERIOR IRON MINES.

The following is an approximate statement of the shipments of iron ore in gross tons by mines in the season of 1902 over the lines of the Duluth & Iron Range and the Duluth, Missabe & Northern roads. For comparison the figures for 1901 are given:

DULUTH & IRON RANGE ROAD.

Mines.	1902.	1901.	Mines.	1902.	1901.
Minnesota	280,000	208,284	Minorca	35,500	.....
Chandler	645,000	627,322	Roberts	29,000	42,757
Pioneer	675,000	678,301	Hale	54,300	30,972
Zenith	167,200	60,037	Kanawha	24,800	41,300
Savoy	243,000	212,700	Union	103,500	.....
Sibley	77,000	.....	Petit	17,300	.....
Auburn	38,200	427,510	Franklin	84,500	36,430
Faval	1,920,000	1,656,830	Wills	12,000	.....
Genoa	400,000	332,021	LaBelle	70,700	.....
Elba	212,000	224,629	Victoria	26,500	.....
Corsica	59,300	26,837	Spruce	.....	47,628
Sparta	254,800	154,557			
Malta	179,400	128,220	Total	5,609,000	5,027,444

DULUTH, MISSABE & NORTHERN ROAD.

Mines.	1902.	1901.	Mines.	1902.	1901.
Adams	1,240,117	889,118	Lincoln	87,779	.....
Duluth	150,220	150,024	Biwabik	623,128	410,075
Pillsbury	237,106	120,708	Oliver	5,131	.....
Sellers	192,234	34,918	Mtn. Iron	1,428,383	1,158,160
Burt	99,939	118,160	Aetna	190,796	.....
Hull	321,442	302,462	Spruce	514,162	.....
Rust	242,198	174,156	Cloquet	22,803	.....
Day	106,037	.....			
Glenn	23,421	.....	Total	5,594,896	3,357,781

The ore supplied from the Allouez (Great Northern) dock at Superior, was 2,321,079 tons in 1901 and 4,175,716 tons in 1902.

The Williams estate, of Chicago, which has been exploring in section 4 and 9, T 58 R 16, Mesabi range, for the past year, on lands of its own, has found a very small deposit of ore in section 9, being in the ne of the nw ¼. After the State had abandoned exploring in section 4 the work was taken up by others, who have found some ore, though not in any great quantity. Directly east of section 4, work that has been under way under the charge of A. Jarchow, for Oliver & Snyder, has ceased. On adjoining lands to the south the Minnesota Iron Co. is exploring, but as yet has made no finds. The ore bearing horizon is here very narrow, so far as exploring has shown, and the work done in that region has been largely unproductive. In section 8, just west of where some of this above mentioned work has been going on, the Roberts mine lay right up on the diorite, and has now been mined out so far as any exploited ore lenses lay. This has just been abandoned and the machinery removed, after the mining of about 200,000 tons. Roberts carried on some explorations squarely on top of the diorite, southwest of his operations, but found nothing. It is reported that explorations will be undertaken soon to the southeast of the old mine, where the ore bearing formation has thickness enough to be at least a possible field. The McKinley mine, belonging in fee to the Minnesota Iran Co., lies just east of this point and is known to contain considerable of a deposit, though just how large is not generally understood. A quarter of a mile further to the southwest Messrs. Maitland, Thompson, and others are opening their new Wills mine, and are shipping this fall a first lot of about 10,000 tons of excellently coarse ore. Adjoining them to the southwest, Pickands, Mather & Co. have a very considerable deposit of low grade ore, before reaching their Corsica and Elba mines, which are in line still further southwest, and adjoining the last exploration. This is all the exploration going on now in that township, except at the east end. There Alfred Merritt, of Duluth, has a couple of drills working in the bottom of a basin between the village of Biwabik and old Merrit townsite, and though quite low in surface and deep with his holes is in gravel and boulders all the way down. This work is in the north central part of section 11. In section 1 the old Kanawha and Hale mines will probably be abandoned and explorations will be undertaken to extend their ore body. East of these mines the W. P. Snyder explorations that were going on in section 6 T 58 R 15 have had no result and have been stopped.

The Canada Steel Shafting Co., of Toronto, Ont., has been incorporated with $100,000 capital. Samuel May, C. F. Wheato, H. S. May and R. A. Fraser are the incorporators.

American Society of Mechanical Engineers.

The 46th meeting of the American Society of Mechanical Engineers was called to order at the house of the organization on 31st St,, New York, on the evening of Dec. 2. A letter from the president, Edwin Reynolds, of the Allis-Chalmers Co., was read explanatory of his absence. Mr. Reynolds has been far from well during the later portion of the year and while now in much better condition had imperative orders from his physician preventing his participation in the gathering. Vice President Arthur M. Waitt took his place as chairman during the sessions and conducted the business with patience, courtesy and skill.

The attendance of members was large, particularly on Wednesday and Thursday. Friday brought the blizzard and transportation was slow. Besides, some of the members were compelled to return to business. From start to finish there was no lack of interesting material and the numerical strength of the meetings was well maintained. The number of members and guests registered during the convention was 686.

The Metric System.

The paper by Sidney A. Reeve treating of "A Rational Solution of the Problem of Weights and Measures" was introduced by the author at the Tuesday evening session. Mr. Reeve touched upon that prolific source of discussion, the metric system. His argument was of a decidedly constructive character and in presenting the matter he wasted no time in anticipating the next paper on the program. Mr. Reeve called attention to the fact that some half dozen years ago he had given attention to the preparation of a duodecimal system of weights and measures and had satisfied himself fully as to the value and feasibility of the project. The method had been laid aside and but recently he had taken it again in hand in the preparation of the data for the society. He certainly exhibited a facile skill in handling the subject that greatly added to the general interest.

Mr. Reeve asserted that the mental burden involved in carrying in the head a duodecimal multiplication table and in performing with it the simplest arithmetical processes is much less than with the decimal system. Furthermore the degree of accuracy of a given number of significant digits is much enhanced. Four duodecimal digits possess twice the accuracy of four decimal digits; six possess three times the accuracy and nine possess five times the accuracy. The general use of division by twos and threes in connection with decimals shows a trend of thought and practice which is not to be ignored in the adoption of any system. The readiness with which everyone thinks in dozens would easily lead to the ready use of one-quarter, one-third, one-half, two-thirds and three-quarters of a dozen.

The adoption of the foot and inch can be followed in the proposed arrangement, Mr. Reeve advising the writing of the decimal series: 1′ 3″, 2 feet 7½ inches, 5 feet 3¾ inches as 1.3 feet, 2.76 feet and 5.39 feet in the duodecimal linear measure. The yard is suggested as the base for the duodecimal system of weights and measures and the standard table of lengths as:

1 mile = 1,000.. yards (= 1,728 yards).
1 yard = 10.. trinches (= one dozen 3-inch lengths).
1 trinch = 10.. quarters (= one dozen quarter-inch lengths).
1 quarter = 10.. groats (one groat = one-forty-eighth of an inch).

The professor outlined in his paper the application of the duodecimal system to square and cubic measurements, liquids, weights and money and a careful study of the paper in full is necessary in order to do justice to the ingenious effort made by the author. The system bears the evidence of so much clear judgment in the preparation of the data and is so well constructed that one cannot but regret the hopeless outlook for the introduction of such a project into the field of industry. It may be that the difficulty is in reality not so great as at first appears, but there is little or no expectation that the obstacles are other than insuperable. The advantages are summarized by the author as follows: Harmony between the systems of measures and of notation which is all that the metric system has to offer; greater facility in computation, which is what the scientific world especially desires; division of units by twos and threes, which is what the people especially desire, for they cannot live without it; a large measure of consistency with existing standards, it being absolute and accurate in linear measurements and so closely approximate in weights and measures of volume as not appreciably to disturb popular conceptions; possibility of a gradual transition from one system to another, not without great cost, but without catastrophe. Prof. Reeve added finally that all English-speaking people ought long ago to have united in making the standard gallon contain 216 cubic inches, or a cube measuring 6 inches on an edge; the standard pound ought to be the weight of a pint of distilled water at maximum density, and the ton ought to be a cubic yard of the same. These changes can be undertaken today to an advantage well worth any disturbance they might create, whether any duodecimal system of numbers be contemplated or not. And yet, in the opinion of the professor, when these things are once done it will appear that the bulk of the cost of the adoption of duodecimal notation to the industrial world at any rate has already been overcome.

Discussion.

Most of the members who had given notice of a desire to participate in the discussion of the paper were not present at this early stage of the proceedings but the author did not fail to receive commendation for his labors and congratulations upon the result. H. H. Supplee in discussing the paper, reminded the members of the work of the late John W. Nystrom who had undertaken a similar labor a dozen years ago. Mr. Nystrom, however, adopted a system of 16ths rather than the duodecimal plan. The method was used in connection with Mr. Nystrom's work on steam engineering and in all probability was only brought to a close by his death rather than any change of opinion.

This information prompted an inquiry by Wilfred Lewis in regard to the superiority of a division by 12ths rather than 16ths. The professor directed attention to the value of dividing by three in the former instance but leaving out this advantage he felt that the foot, inch and yard are inseparably connected with the number three. A question by F. A. Halsey elicited the professor's views in reference to the possibility of the two systems, the duodecimal and the one now in common use, being jointly employed in the same machine shop and in reply it was urged that the machinist need know only the common system, as the two scales could be on the same rule and the one would be immediately comparable with the other. Men would translate from one system to the other by an easy transition and would unconsciously acquire, slowly but steadily, the habit of thinking in quarters. The calculations of the drafting room are directed at results and as developments demonstrated the greater ease and security of the new system the old would be abandoned. During this period calculations would be made either in the one system or the other and finally translated into the one method. Some of the shop expressions are peculiarly adapted to the plan proposed and tapers expressed in 12ths, for example, would be easily converted from the one to the other. Mr. Reeve had found it easier to think in dozens than in decimals and called attention to the common practice of the shops in splitting thousandths up into fractions which were not decimal divisions. This tendency was directly in line with the proposition he offered and the system allowed a nicety of handling the finer divisions that accorded well with the shop practice. The author intimated that the time required for an investigation of this sort was not easily spared from the scant store of a busy man and that his further research might be influenced by an expression of opinion of his hearers. The undoubted interest of his audience did not go to the extent of pronouncing a verdict upon the question, the subject matter was not sufficiently familiar to the majority and whether such labor is really worth the while is for individual consideration. The treatment of the subject was most acceptable and a greater elaboration would be of keen interest to many. The professor had prepared some scales and several calculations which illumined his argument and should be added to the discussion.

Following the presentation of the paper there was a "smoker" and the usual opportunity to increase the general acquaintace.

WEDNESDAY'S SESSIONS.

Wednesday morning, Dec. 3, the meeting was held on the

second floor of the Sturtevant House, 29th St. and Broadway. This was the business session of the annual meeting and the attendance was large. The report of the council showed an increase in membership during the current society year of 226. The committee on rules rendered a report of progress through the chairman, Robert W. Hunt. The continuance of junior members on the books of the society for an indefinite period at a minimum and inadequate rate led to a spirited debate. The several resolutions declared that it was not the sense of the meeting that the dues of junior members should be gradually increased until they were equal to those of associate and full members, and that it was equally the judgment of those present that all junior members hereafter elected should cease to be members after the age of 30 years. This is tantamount to the student provision in the rules of the civil engineers of England which require the probationer to advance or withdraw on the attainment of the age limit.

The tellers, Wm. T. Bonner and Paul M. Chamberlain, announced the result of the balloting on the election of officers: James M. Dodge, president; Fred H. Daniels, James Christie, John R. Freeman, vice presidents; Messrs. McKinney, Webber and Sanders, managers and F. H. Stillman, treasurer.

The final report of the committee on standardization of engine tests was then presented by Prof. D. S. Jacobus and adopted after some appreciative comments by Wm. Kent upon the perfected labors of the committee.

The four engineering societies, the American Society of Mechanical Engineers, the American Society of Civil Engineers, the Institute of Electrical Engineers and the Mining Engineers, having been asked to appoint a committee of fourteen members in connection with the award of the John Fritz medal, the quota of the A. S. M. E. was designated as follows: G. Lanza, John E. Sweet, S. T. Wellman and Robert W. Hunt.

Again the Metric System.

The paper prepared by F. A. Halsey on the metric system was read sometime ago at the Cleveland meeting of the National Association of Machine Tool Builders and was summarized in the columns of *The Iron Trade Review*. As presented at the present meeting no important change was noted. Mr. Halsey vigorously arraigned the bill before Congress and the statements made to the committee on coinage, weights and measures of the House of Representatives. Considerable of the testimony offered at Washington was to the effect that machinery made to metric dimensions could be bought by the government at little or no advance in cost over that made to English dimensions. The author of the paper called attention forcibly to the absurdity of such assertions. Mr. Halsey exhibited a collection of German-made scales, forwarded by an American engineer, Henry Hess, a member of the society now holding a responsible position in Berlin. The scales exhibited all the characteristics mentioned in the paper and were examined with much interest, fully bearing out the assertions of Mr. Halsey.

The introduction of the subject by the author of the paper was followed by a written contribution by Fred H. Colvin who had made a careful investigation of the recent consular reports published by the State Department at Washington and collected a store of data in regard to the treatment of foreign weights and measures by the consuls of the United States. The result evidenced a curious conglomeration of the different standards abroad. A number of letters received by the secretary were then read. That from Vice President Bullard, of the well known firm at Bridgeport, Conn., asserted that the changes made in machine tools for the export trade were very few indeed, not more than 1 percent of the total sales in foreign countries requiring a change in the lead screws. Fred L. Eberhardt, of Gould & Eberhardt, Newark, N. J., wrote that the only demand for any machine tool change by foreign customers was confined to their line of gear cutting machinery and was very limited at that. The change only involved the cutter arbors and the screw, the former being sized to the metric system. Mr. Dunn, of the Laidlaw-Dunn-Gordon Co., of Cincinnati, was strongly opposed to any interference as indicated by the proposed bill. The firm had never had occasion to conform to foreign measurements and was convinced that a change from the English to the metric system could not be made in its plant for less than $100,000. C. J. W. Woodbury did not believe that the metric system should in any sense be compulsory but thought it could be applied with advantage to the textile industry. A number of letters from manufacturers opposed to the metric system were briefly summarized, the firms named including the Dietz Machine Co., Cincinnati Planer Co., Cincinnati Shaper Co., Cincinnati Machine Co., Northern Engineering Co., Greaves-Klussman Co., Aurora Tool Works, Lane & Bodley, Cincinnati Milling Machine Co., Baldwin Locomotive Works, Cincinnati Punch & Shear Co., Schumacker & Boye, Lodge & Shipley Machine Tool Co. Several communications in favor of the change were similarly presented and these included letters from Dr. E. Kennelly; W. W. Crosby; C. A. Bates, of the Treasury Department at Washington, who was of the opinion that the change should be made on an 8 years' notice; Mr. Tittman, of the Treasury Department Geodetic survey; and Dr. Pritchard, of the Massachusetts Institute of Technology.

The conclusion cannot be avoided that the manufacturers are on the opposition side of the matter if the reading of the letters is any criterion.

F. W. Stratton, director of the National Bureau of Standards at Washington, was introduced and made a strong plea for the metric system, commenting freely upon Mr. Halsey's paper. He said that the consular mixture of measures was due to the practice of these representatives of translating into their own experience and naturally adopting the terms which were familiar. On the ground of standardization alone he believed the change should be made and the expense, great as it might be, would be as gradual as the change in the adoption of the metric system. The difficulty in obtaining a change of measures not only reasonable and to be expected but a desirable feature as showing the permanency of a system admittedly imperfect and the existence of a condition which would ensure the greater stability of a better method. His personal investigations in France and Germany had convinced the speaker that the results of the metric system in actual operation there were most satisfactory. The mere fact that the change would be difficult should not be enough to defer its adoption by the manufacturers of the United States. The speaker read a letter from Andrew Carnegie in favor of such a change and also read from statements of John Quincy Adams to show that while he was not in favor of the adoption of the metric system at that time he was certainly not of a belief that it would not ultimately be adopted. The purpose of the government looked toward improvement and uniformity but never compulsion. The speaker would be the very last to favor anything looking to the making of the metric system compulsory among the industries.

The House Committee Heard.

J. H. Southerd, chairman of the House Committee on Coinage, Weights and Measures, was invited to the platform. He evidenced a virile, straightforward personality not easily phased and his address and the subsequent running fire of pointed interrogatories were keenly relished, an enjoyment by no means confined to those who agreed with his views. Mr. Southerd outlined the work of his committee and the numerous invitations extended to those in their opinion competent to express convictions of value on the subject. He admitted that some opposition was only to be understood on the supposition that any foreign method would naturally meet antagonism. He had heard one man object to the metric system because it was French. He told in breezy style the story of the poor woman who prayed for bread and was overheard by a man who promptly sent the food. The sender took the opportunity, however, to tell the woman that he had heard the prayer and answered it. She replied that "the devil may have brought it but God sent it just the same." If the metric system was a good thing the proposed law would afford an excellent opportunity of demonstrating the merits of the scheme. Already it had been adopted in the department in charge of Surgeon-General Sternberg and was working successfully. Adoption in every department of the government was only "trying the thing on the dog." He thought any fear of a compulsory future with the project was uncalled for and mistaken. The Attorney-General had had the matter under consideration and Mr. Knox held that there was nothing compulsory about the bill and the eminence of such authority should be convincing. The only object of the pending bill was in the direction of uniformity and this intention should be better understood.

Granting that the sad mixture of measurements, metric and otherwise, existed in the different countries, the worse the situation the louder the call for a remedy. If it operates well for government uses it may popularize the metric system. The speaker paid a cordial compliment to the status of the mechanical engineers and then brought them back to earth by saying: "You are not the whole thing; there are others."

Mr. Southerd was asked a number of questions and ran the gauntlet of his questioners good humoredly but he did not seem to consider the requirements of the pending bill as meaning an inevitable change of standards even by the shops which might figure on government work. He evidently thought the needs of the situation could be met by the translation of the main dimensions into their metric equivalents and on the basis that the requirements of the departments would be couched in general rather than specific measurements, should not be less than the limitations assigned but might be more generous in capacity at the pleasure of the bidder. Such a plan would pave the way for the more complete adoption of the metric system and in the later designs of machinery the system would probably be more closely applied. At present he considered that two-thirds of the people of the earth used the decimal system and he thought the service of the method in the instruction of the young was sufficiently advantageous to ensure favorable consideration.

Further Discussion on Weights and Measures.

During the special session from 2:30 to 6 p. m. and in the evening from 8:15 to 10:30, some thought-provoking contributions pro and con were advanced. These included careful surveys of the subject by Fred J. Miller and James Christie, both in favor of the metric system, the former having found it commonly employed in foreign shops during his personal investigation there and the latter convinced that the saving of time in computing in the metric system outweighed the disadvantages incident to any change in established customs. Like Mr. Halsey's paper, the contributions by Messrs. Miller and Christie cannot with justice be condensed, and deserve examination at length. During the evening session Mr. E. P. Bates read a contribution which largely consisted of quotations from a book treating of that miracle of masonry, the pyramid at Gizeh. The paper undertook to demonstrate a closer connection between the dimensions of the pyramid in inches and the length of the earth's axis and inferentially that the inch had the divine sanction rather than the meter.

The logic of Mr. Halsey's paper was vigorously assailed by Mr. Henning who cited a number of instances in point. He had sent drawings of machines to Germany which were dimensioned in the English system but the fact that these were to be used in the greatest of industrial plants over there would not be sufficient to prove that Krupp had abandoned the metric system in any particular. Nor was the use of the English inch in some German shipyards inexplicable. It meant the use of English structural shapes and sizes to an extent warranting the service of the foreign units of measurement.

H. H. Supplee suggested the influence of the great commercial nation upon weights and measures in other countries. He instanced the position of Great Britain in this particular and the adoption of the nautical mile in navigation and the English foot in shipbuilding. The large modern vessels of the German line now coming to New York had the draft measured by a scale of feet painted on the forefoot of the ship. W. S. Rogers had had an experience in turning metric dimensions into English equivalents on a set of drawings sent him from abroad for a special machine. This was carefully worked out in the drafting room and then sent into the shop where a son of the Emerald Isle discovered that the figures of the special machine were identical with one of those made in the regular course of business by the firm, a circumstance suggesting that the foreign draftsman had been at work also in digging out equivalents.

Late in the evening Mr. Halsey summed up the progress of the day's labor. The task was an extensive one and far from easy but the author of the paper was not dismayed either at its magnitude or the condition of his argument. He felt that no good reason had been shown for the passage of the bill now before Congress and even the strongly asserted simplicity of the metric system in computations was discounted by the growing use of the slide rule. He wanted it to be understood that the original action of the society in opposition to the introduction of the metric system had never been rescinded and he was of opinion that the organization had been greatly misunderstood in this regard.

THURSDAY'S PAPERS.

Thursday morning the meeting was again held in the banquet hall of the Sturtevant House and the committee to which had been referred the consideration of the metric system in comparison with the shop system in use in the United States made a report of progress accompanied by some strongly worded resolutions in oposition to the proposed introduction of the metric system. The matter was laid upon the table. Resolutions were adopted instructing the council to confer with other engineering societies and to consider the appointment of a committee to act jointly with others. A resolution was also adopted to the effect that at no time had the society rescinded the original action in regard to the metric system.

Mr. Reeves presented his paper on "Entropy Analysis of the Otto Cycle" which was briefly introduced and in reply to a query by H. H. Supplee the author thought the methods were applicable in considering the action of the Diesel engine but his investigation in this direction had not been an extended one.

The papers by J. C. Riley on "Apparatus for Obtaining a Continuous Record of the Position of an Engine Governor," by W. I. Slichter, on "Flywheel Capacity for Engine Driven Alternators," and by William Kent, on "Heat Resistance the Reciprocal of Heat Conductivity," were briefly introduced but not discussed at length.

A 44-foot pit lathe in the shop of the Bullock Electric Co., at Cincinnati, was described by J. M. Barnay who said the tool was capable of removing 64 cubic inches of cast iron per minute. The cutting requiring .35 of a horsepower to remove 1 cubic inch of cast iron per minute. The use of paper friction rolls for conveying power was briefly treated by Messrs. Miller and Supplee, both agreeing upon the importance of certain surface velocities in best utilizing such means of conveying power. Mr. Supplee added that in saw mill work a width of 12 inches of compressed paper had served to transmit from 35 to 40 horsepower. He proposed to prepare some data along this line of investigation for presentation to the society.

Finer Screw Threads.

Chas. T. Porter submitted his paper on "Finer Screw Threads." Mr. Christie had given the matter some attention and told of the experience with bolts for bridge work which had resulted in the adoption of 6 per inch for a wide range of the larger sizes. Mr. Fred J. Miller was of the belief that the common threads were too coarse for steel screws but it was a matter for further investigation whether they were too coarse for bolts which were frequently removed and replaced.

The paper by C. C. Tyler on "A Surveying Instrument in the Machine Shop," was especially interesting as it had been applied to some of the large alternators in the power stations to which the members had been invited during their stay in New York. The paper describes the system followed at the plant of the Westinghouse Electric & Mfg. Co., of which the author is superintendent, and suggests how the use of 10-foot steel squares and beam compasses spanning 25 feet was avoided. The subject started a series of reminiscences of the use of the transit for the alignment of shafting. The instrument had been used for bringing a number of countershafts parallel by means of an offset from the main line shaft even though they were at different heights. The use of the transit in lining up machinery before the completion of the building as well as the leveling of shafting over uneven surfaces, the latter at the Centennial Exposition, was described. Mr. Miller told of a line of shafting that was leveled periodically but was finally leveled with the transit and needed no further attention, proving that the work had never been properly done. He joined the preceding speakers in scoring the average shop level as a vile and inaccurate instrument. Mr. Tyler in closing the discussion reminded the members that his use of the transit was not for lining up shafting, that he had been familiar with its use for such purposes for a long time but in the direction traversed by his paper he was inclined to think it broadly novel. At any rate it was new to him and he was

happy to have an opportunity of showing them the results attained by means of the machinery in Manhattan.

Bonus and Premium Systems.

"Gift Propositions for Paying Workmen," by Frank Richards, was next in order and had a spirited treatment. The author disagrees with both the "bonus" and the "premium" plan and feels that neither do full justice to the workman. His paper will be published in full in *The Iron Trade Review* and need not here be summarized. During the discussion the opinion was expressed that the piece work rate should not be over 70 percent of the day rate; that the possibilities of production were greater with a stimulus and that shop records agreed everywhere regarding the increase of wages and cutting of cost with satisfaction to both employer and employed when something of the kind was carefully introduced and skillfully administered. The choice between the different methods available was really the point at issue. E. S. Boyer told of the improvement made in the erection of steam engines by alloting one man to the task and apportioning a certain sum for the work. The man hired his own help, supervised the task with judgment and finished the work speedily at a profit to all concerned. In this case the employe was given the unexpended remainder of the amount appropriated for the labor. W. S. Rogers had introduced the premium plan in a number of shops and after he had left for other fields of usefulness the work had been promptly undone by his successors. He had heard that the "bonus" system had also been thrown out of the Bethlehem Steel Co. since its discussion before the society a year ago. He knew of one really satisfactory method of building up and retaining the interest of the employe and that was by a participation in the profits. A share of stock would mean an active interest. This plan is often adopted in the case of the higher salaried men and might be extended with profit. He cited the case of the plant at Ivorydale with approval as being conducted amicably and vigorously along these lines. The statement of Mr. Rogers in regard to the condition at South Bethlehem was emphatically denied by H. L. Gantt, who submitted an account of his later work with the bonus plan of wage payment which is appended:

Mr. Gantt on the Bonus System.

"To take up even the most pointed issues Mr. Richards offers would require too much time, but the statement that workmen take no interest in their work, and have no desire to do better is the reverse of the experience of the writer with men working under *permanent piece* rates or the 'bonus' system. If Mr. Richards had read Mr. Taylor's paper on a piece rate system or my paper on a bonus system and attempted to verify the statements made in them, he would, I think, have left a large part of his paper unwritten. The second is simply an outgrowth of the first and is simply an attempt to carry out the same principles in a more elastic manner.

"Our object is to buy labor, and before attempting to do so we should try to find out as nearly as possible on what conditions those who have it for sale will put it at our disposal. A study of the subject from statistics reveals, among others, the following facts about the ordinary workman:

1. For a fixed daily wage he will seldom do more than a fraction of the work he could do.

2. He usually follows very closely the methods he has been taught and is generally incapable of improving them to any great extent without assistance.

3. He is generally satisfied to jog along according to his old methods at his habitual speed for a specific day's pay, but will generally, if a sufficient financial inducement be offered work to his full capacity and follow exactly instructions laid down.

4. This additional incentive has been found by experience to vary with the class of work from 20 to 80 percent of his day's pay.

"If the work is light and the workman is not physically tired at the close of the day this extra compensation may be as low as 20 percent. As an actual example of this class I may cite the running of a metal saw, in which the extra labor of the workman is making changes quickly and seeing that his machine is in condition to do its best work. If the work is such that the man becomes physically tired at the end of the day this extra incentive must be from 30 to 50 percent. The running of ordinary machine tools such as lathes, planers, slotters and drill presses come under this head, as do most kinds of ordinary laboring work such as shoveling coal, sand, ore, etc., the handling of iron, the chipping of castings, etc.

"If in addition to becoming physically tired the workman has to be subject to unpleasant conditions, such as excessive heat, smoke or gases he requires a higher incentive to make him do all he can. From 60 to 80 percent will cover the usual conditions of blacksmithing, hammering and work around furnaces. As an example of an extreme case I may cite the hammering of tool steel, which falls within these limits. There are undoubtedly conditions that call for a higher extra compensation but what I have cited will answer my purpose of illustration.

"The conclusion from the above statements is that no matter what the work is or how slowly it is being done by ordinary day work, we can by determining the proper amount for a full day's work and offering a suitable compensation for its accomplishment get a large number of men who will work at the increased speed in order to earn the reward which, for want of a better name, I have called a bonus.

"The problem of determining a full day's work has been studied very thoroughly by Mr. Taylor and in his paper on a piece rate system the subject of investigation has been gone into and the necessity of educating the workman to follow the directions of the expert fully explained.

"In my paper on the bonus system I have shown how this educating can be done by instruction cards, which serve also as permanent records of expert work. When my paper on the bonus system was read last year a number of people said the principles had been applied only to certain classes of work and were not generally applicable. Soon after reading the paper referred to, the writer had an opportunity to go with the American Locomotive Co. as consulting engineer, and realizing that if the principles were applicable to locomotive building they would be universally applicable, he accepted the position at once.

"On account, however, of the large amount of preliminary work it was necessary to do and the fact that all the plants of the combine except one had in satisfactory operation a system of piece or contract work, the field for the application of the bonus system itself was limited to the one plant which was being operated on day work. I am able to say that in this plant the system has been successfully started, and not only are those men to whom it has been applied pleased, but their neighbors are pushing their machines harder than they ever did before with the hope evidently that they will be chosen next. This is exactly the reverse of the effect produced by the ordinary piece work.

"I should do the subject an injustice, however, if I should stop here, for a certain amount of work based on the principles of the bonus system with instruction cards is being done in other plants of the American Locomotive Co., and with such success that at the request of one of our superintendents I have recently been to a steel foundry furnishing him with castings, to help them adapt the system to their work with the hope on the part of our superintendent that he will get his steel castings with the same satisfaction that he now gets iron castings from his own foundry. These satisfactory results are gotten by keeping a daily balance of work done on a sheet that serves the same end for a whole order that the instruction card does for work on a single piece in one machine. By means of such a sheet or series of sheets we are enabled to compare graphically each day what has been done with what ought to have been done and use our energies in pushing forward that which is behind.

"Naturally such a sheet should be first introduced in the foundry and the forge, for to ship a locomotive on a certain day each casting and forging must be made a definite length of time before that day to allow for machining and erecting. Such a sheet for the foundry shows the date each casting should be made and is made, and a proper series of sheets for the machine and erecting shops show the route each piece should take and the rate of progress it should make to arrive at the erecting shop in time to be incorporated without delay in the locomotive. This series of sheets may be likened to a train schedule, the instruction cards being directions or time

[Continued on page 46]

PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The 123rd meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club in Philadelphia, on Wednesday, Dec. 3, the newly elected president, Thomas Devlin, occupying the chair. The following were present, all being from Philadelphia except as otherwise noted:

Thos. Devlin, Thos. Devlin Mfg. Co.
Richard Moldenke, secretary American Foundrymen's Association.
Thos. I. Rankin, Abram Cox Stove Co.
R. C. Oliphant, Trenton Malleable Iron Co., Trenton, N. J.
Wm. F. Neff, Baldwin Locomotive Works.
F. E. Hemsher and J. H. Sheeler, Sheeler-Hemsher Co.
H. A. May, Theo. B. Rohrman.
Wm. F. Bernstein and Andrew McClay, Bernstein Mfg. Co.
H. Armour Ward, J. S. L. Alexander and M. I. Ardrey, American Brazing Co.
H. C. Matlack, Frank Samuel.
Stanley G. Flagg, Jr., G. Flagg & Co.
A. A. Miller, *Iron Age*.
Geo. C. Davis, chemist.
W. L. Hallewell, Harrison Safety Boiler Works.
E. E. Brown and C. R. Brown, E. E. Brown & Co.
W. A. Devlin and H. O. Evans, Thos. Devlin Mfg. Co.
Wm. Hanson, Pennsylvania Iron Works Co.
J. Hy. Pepper, *The Iron Trade Review*.
P. D. Wanner, Reading Foundry Co., Reading, Pa.
W. E. Arnold, L. & R. Wister & Co.
E. M. Taggart, J. W. Paxson Co.
Oregon J. Ward, Howe Scale Co.
F. C. Pullman, J. Wesley Pullman.
J. J. McCrystal, Girard Iron Works.
T. B. Harkins and J. H. Brooks, T. B. Harkins Foundry Co., Bristol, Pa.
Chas. Link, Thos. Devlin Mfg. Co.
Howard Evans, J. W. Paxson Co.

The treasurer reported a balance in the treasury of $1,994.24, and all bills paid.

A letter was read from J. W. Moyer & Co. announcing their acceptance of the secretary's proposition that they prepare a paper to be read at the next meeting on the subject of "Tramways in Foundries."

The Sheeler-Hemsher Co., of Philadelphia, brass founder, was nominated for membership in the association and duly elected.

Saving the Scrap Pile.

An address was made by Armor Ward, president of the American Brazing Co., Philadelphia, his topic being, "Saving the Scrap Pile." In the course of the address Mr. Ward described the process employed by his company for repairing broken castings. The medium used was "Ferrofix," a name given to it by its German inventor and signifying the fixing of iron. By the aid of this medium, the preparation and sale of which is controlled by his company, the speaker showed how castings could be brazed at the point of fracture. Photographs were shown of broken castings and accompanying these photographs of the same castings as repaired. These included gear wheels and some loose end castings. It was stated that the discovery of the process of brazing cast iron had changed the methods in European foundries with reference to complicated castings, especially in the case of large castings where a flaw or imperfection of any kind involved the relegation of the piece to the scrap pile.

The patterns were now cut into two or more parts, so that each was a simple piece to mold, and the several parts that went to make up the whole were brazed together, so that in effect when the brazing operation was complete, the several pieces that went to make up the whole casting were as one entire casting, and the cost of production had been materially reduced, in that the cost of brazing was very much less than the cost of molding one large casting, as against two or more smaller pieces.

Mr. Ward explained that flaws in castings were eliminated by drilling these out if they were small, and brazing a plug in made to fit the hole. If they were large, and in the nature of a crack, if the crack was wide, a piece of any kind of iron was fitted into the space, and brazed into place. If narrow, the crack was cleaned out thoroughly, and brazed up. If it was so that it could not be cleaned in this way, the fracture was extended by hammering until the entire break could be reached to clean, even if this involved breaking the piece entirely in two. The cost of the Ferrofix involved was about half a cent per square inch of surface brazed.

In tests made for the Government in Berlin, at the Stevens Institute in Hoboken, at the University of California, and by the Pennsylvania Railroad, it has been demonstrated that the brazed joint was not only stronger than any portion of the casting of equal section, but that the iron adjacent to the joint had its strength increased perceptibly, the tensile strength being raised from fifty to two hundred pounds, and the transverse strength as much as two thousand pounds. It was believed that this was not due to any action of the chemical on the iron, but was entirely owing to the fact that in cooling down from the brazing heat, this cooling down was much more rapid than when the casting was originally made, the effect on the iron being to increase its strength, by reason of this more rapid cooling.

With the practice in Europe in mind, Mr. Ward asserted his belief that the introduction of this brazing process must affect the shop practices as radically as was the case there. As the result of his investigations in Germany, France and Belgium, Mr. Ward stated in his judgment at least seventy-five percent of the flaws that ordinarily destroy the value of a casting could be eliminated, and the piece made sound and serviceable at a small fraction of the cost of remolding and as one of the banes of the foundrymens' business was the loss accruing from the imperfect castings, and this process seemed to solve the trouble to a very large extent, he hoped the gentlemen present would experiment with the process on such lines as they deemed requisite for adding to the knowledge of its use. Several small pieces were exhibited, but as there were no means of testing the strength of the joint, it could not be determined just how satisfactory the joints were for strength, although to all appearances the pieces were as sound and strong as if they had been molded perfectly.

Mr. Ward stated that the only difficulty encountered in doing large pieces was in cases where the casting was joined in such manner as to prevent free expansion when only a small portion of the casting adjacent to the fracture was heated. As castings of this peculiar character were not as commonly encountered as the other kind, the trouble arising from it was not so serious; and even in such castings, when the entire piece could be heated more or less, the brazing operation was successful.

The chief peculiarity of this process of brazing is, that it is always perfect when the work is properly done. Its simplicity and cheapness were remarkable in view of the fact that in brazing steel or brass an expert in that art is usually required, in order to insure having a good job, but in Ferrofixing by the American Brazing Company's process no expert skill was required. The alignment of the piece was unchanged, the surfaces whether machined or not were not disturbed in any way, and after the completion of the brazing operation, all that was necessary was to clean off the surplus brass, and the piece would be found as sound and true as a perfect casting.

Mr. Ward stated that several manufacturers in Germany were brazing brass heads on steel bolts, where conditions would permit of this being done. Brass was required for appearance sake, and steel for strength. The practice in the German shops, however, is to pay more attention to the looks of a machine than is the practice here.

In answer to inquiries made by several of the gentlemen present, Mr. Ward stated that this process of brazing would fasten any two metals together, excepting possibly in the case of aluminum. They had made no experiments in that direction, but meant to take the matter up just as soon as conditions would permit. His company had been so busy arranging for the introduction of Ferrofixing to the iron trade that no opportunity had been reached that would allow them to make the aluminum experiments, but they expected to try this class of work in the near future, as the demand had been made upon them by several manufacturers, and there seemed to be a general desire to know how the trials would come out.

In the discussion following the paper Mr. Outerbridge asked: "Do I understand you to say that a casting is as strong after brazing as before the fracture?"

Mr. Ward: Yes, quite so. The strength of the brazing material used is greater than that of cast iron. We had tests made at the Stevens Institute and other places. On a 1-inch bar breaking at a 2,300 pound test, we reached a tensile strength of 13,000 and 14,500 pounds after brazing. When brazing care must be taken to see that the parts to be joined are free from rust or grease. The flushing chemicals used entirely disappear during the process of brazing.

Mr. Outerbridge then, by request of President Devlin, read an address which he had delivered recently to the students of the Wharton School of Finance of the University of Pennsylvania on "The Premium System of Payment." The address, which was quite long, is to appear in the Unversity's journal in January. Mr. Outerbridge explained that the pupils of the Wharton School visit industrial plants in a body, not for the purpose of studying the mechanical features so much as the managerial.

After the reading of the address Dr. Moldenke, the secretary of the American Foundrymen's Association, addressed the meeting on the subject of affiliation with that organization. He referred to the good work done by the American Foundrymen's Association, and the standards it had promulgated, and urged that by the affiliation of the Philadelphia body the means would be provided for an extension of the work now being done, both in research and standardization. No action was taken in the matter, but it was arranged to bring the subject before the association at its January meeting.

The meeting then adjourned to the club café where a lunch was served and an hour or two pleasantly spent.

Inspection Tour of Steel Corporation Officials.

(Special Telegram.)

PITTSBURG, Dec. 10.—Leading officers of the United States Steel Corporation arrived in this city this morning from New York on their annual tour of inspection of the Western mills of the corporation. Today they visited the Homestead and Duquesne mills of the Carnegie Steel Co. and also went to McKeesport and looked over the site for the additions to be made to the plants of the National Tube Co. The party will probably leave the city on Saturday morning to inspect the company's plants in the Mahoning and Shenango Valleys and in the Ohio Valley. The next plants to be visited will be those in the Chicago district and on the return stops will be made at Lorain and Cleveland. The party from New York consists of Chairman E. H. Gary, First Vice President James Gayley, and Daniel G. Reid, William Edenborn and E. C. Converse, members of the executive committee. In this city they were joined by W. E. Cory, president of the Carnegie Steel Co., National Steel Co. and the American Steel Hoop Co.; W. P. Palmer, president of the American Steel & Wire Co.; George G. McMurtry, president of the American Sheet Steel Co.; Alfred J. Major, president of the American Bridge Co.; W. T. Graham, president of the American Tin Plate Co.; William B. Schiller, president of the National Tube Co.; and Homer J. Lindsay, assistant to President Corey. After this inspection is completed it is altogether probable that a statement outlining the improvements decided upon will be made public.

New Edgar Thomson Furnace K.

(Special Telegram.)

PITTSBURG, Dec. 10.—A record has been made in the building of the new Edgar Thomson K furnace of the Carnegie Steel Co. Work was begun April 27, 1902, and the furnace was blown in Friday, Dec. 5. The stack is 90x22 feet and the four stoves are 100 feet in height. The work was done under the supervision of John F. Lewis of the furnace department of the Edgar Thomson plant.

Albert C. Barney, of the Barney & Smith Car Co., Dayton, O., died at Monte Carlo, France, Dec. 6. Mr. Barney had not been in active business for a number of years and went to France on account of his health. His home in recent years had been in Washington, D. C.

The Maryland Rail Co., of Cumberland, Md., announces that it is now rolling for prompt delivery T rails of 16, 20, 25 and 30-pound sections.

TO REFUND DUTY ON STEEL.

The House of Representatives at Washington has passed an important Senate bill relating to claims for refunding of duties paid on steel blooms. The bill merely gives the court of claims jurisdiction to determine the justice of the claims and render judgment. The claimants imported, in the years 1879-82, (in the memorable boom in the iron trade), steel blooms upon which they were required to pay a duty of 45 percent ad valorem, although they objected, claiming that 30 percent ad valorem was the legal duty. In 1882, a suit was brought in the United States Circuit Court for the Southern district of New York, and a verdict was obtained against the government for the excessive rate of duty exacted. The decision was sustained by the United States Supreme Court and the Treasury Department instructed collectors to collect only 30 percent ad valorem, but the money illegally exacted has never been refunded.

The claimants are: J. F. Bailey & Co.; H. E. Collings & Co.; Edgar Thomson Steel Works, Ltd.; Carnegie Bros. & Co., Ltd.; James Lee & Co.; Downing, Sheldon & Co.; R. F. Downing & Co.; Albany & Rensselaer Iron & Steel Co.; Joliet Steel Co.; Cleveland Rolling Mill Co.; O. L. Garrison, for Vulcan Steel Co. and Saint Louis Ore & Steel Co.; Saint Albans Iron & Steel Co.; Godeffroy & Co., for the Albany and Rensselaer Iron & Steel Co.; Oliver L. Garrison; A. E. Godeffroy & Co.; James Johnston; Clarke, Post and Martin, agents for Springfield Iron Co.; Post, Martin & Co., agents for Springfield Iron Co.; Sprngfield Iron Co., of Springfield, Ill.; Charles W. Matthews; Harry C. Arbuckle, and Brown Bros. & Co., agents for Charles W. Matthews; E. Samuels & Co.; Henry W. Oliver, Jr.; A. H. Childs, agent for Henry W. Oliver, Jr.; Lewis, Oliver & Phillips; Schrader & Ellery; Peter Wright & Sons, agents for Cambria Iron Co.; Diamond State Iron Co.; Brown Bros. & Co. and C. B. Smith, agents for Diamond State Iron Co.; Interstate Improvement & Construction Co.; Baltimore & Ohio Railroad Co., agents for Interstate Improvement & Construction Co.; Charles H. and Eugene Odell, agents for Sandusky Rolling Mill & Mfg. Co. and Northern Pacific Railroad Co.; Northern Pacific Railroad Co.; Drexel, Morgan & Co.; A. H. Barney and Robert Garrett & Son., agents for Northern Pacific Railroad Co.; E. S. Wheeler & Co., and Edgemore Iron Co.

Advances on Coke and Other Freights.

(Special Telegram.)

PITTSBURG, Pa. Dec. 10.—At a meeting of leading traffic officials of the Pennsylvania Lines, Lake Shore & Michigan Southern, New York Central, Pittsburg & Lake Erie, Baltimore & Ohio and the Erie Railroad held here yesterday it was decided to advance coke rates into and out of Pittsburg about 5 percent. Rates on ore and finished products out of and into this district are also to be advanced proportionately. A committee has been appointed to formulate the new schedule of rates and it is altogether probable that the advances will become effective about the first of the year.

An aggravated case of attempted interference with the operations of a foundry and of the use of deadly weapons by a labor leader is reported from Buffalo. Martin F. Murphy, president of the New York State Federation of Labor, and identified with the Iron Molders' Union as business agent until a few months ago, when he resigned, went to the foundry of the Snow Steam Pump Works on Friday morning, Dec. 5, presumably to call out a number of molders on strike. The unionizing of the foundry, which is now run as an open shop, was the issue. Comparatively few of the men, it appears, left their work and it is stated that Murphy attempted to enter the foundry to persuade others to strike. The foreman ordered him from the shop, and in the argument that followed, Murphy drew a revolver and after pointing directly at the foreman fired five shots into the ground. The men from the foundry ran to the foreman's assistance and in the ensuing scuffle Murphy was injured on the head. He was arrested soon after and in court was released on bail. The case was called on Monday and postponed for one week. The pump works foundry meantime is being picketed and a number of the men at work have been threatened. Thus far the strikers are in the minority.

EASTERN PENNSYLVANIA.

(Special Correspondence.)

HARRISBURG, Pa., Dec. 9.—November was marked by the incorporation by the State of a number of iron and steel companies, some with nominal capital which will be increased.

Harrisburg works have recovered their normal hours, the fuel supply having been materially improved and large outputs are the rule. The companies operating works in Dauphin county are all hopeful of the new year and will start on full time. Every works and every blast furnace in Dauphin county is in operation and production is heavier than ever.

There have been many reports about improvements for Lebanon, where the Pennsylvania and Lackawanna companies have large plants. Officials of the Pennsylvania say that statements regarding their proposed plant at Lebanon are premature, but intimate that a large steel works may be located near their Lebanon furnaces which use Cornwall ore. A coke plant will ultimately be built. The Lackawanna will rebuild its buildings at Colebrook furnaces and install a casting machine. A new blowing engine is being added and additional Cahall boilers will be put in.

The Empire Steel & Iron Co. and the Thomas Iron Co. have increased by 10 percent the wages of their furnace employes at Catasauqua, Hokendauqua, Reading and other places. The advance is effective Jan. 1.

The Eastern Steel Co. will have its Pottsville plant making structural steel at the rate of 125,000 tons a year after July. The rebuilding of the plant is progressing.

The Chambersburg Engineering works has shipped a 1,000-ton hydraulic press to Butler for the new steel car works. The works at Chambersburg are running double turn and employing the largest number in their history.

The Leesport furnace has been stopped for repairs.

The Landis Tool Co., of Waynesboro, has decided to increase its capital stock from $150,000 to $250,000.

The Lebanon furnaces have been interrupted in operation by scarcity of coke. The Pennsylvania Steel Co.'s stacks had considerable losses in November, while the Lackawanna company suffered severely.

Large Plans of the New Union Steel Co.

It has been reported that the Union Steel Co., the new merger of the Sharon Steel Co., of Sharon, Pa., and the Union Steel Co., of Pittsburg, will erect a rail mill in the near future, either at Sharon or Donora, which will have a daily output of about 2,000 tons. Before this mill can be placed in operation, however, it will be necessary to erect at least four additional blast furnaces to supply the iron for this plant. It has also been reported that it is probable that the capital of the company will be increased to $75,000,000, and that bonds to the aggregate of $18,000,000 will be issued. The present outstanding bonds of the Sharon Steel Co. are to be taken up. None of the officials of the company would confirm or deny these stories. It is certain that this company has large plans outlined for the future and it is entirely probable that a plant for rolling structural shapes will be erected among other additions to be made.

A Large Rail Order.

(Special Telegram.)

PITTSBURG, Pa., Dec. 10.—The Carnegie Steel Co. has closed a contract with the Kansas City, Mexico & Orient Railroad for 150,000 tons of rails for delivery next year.

Announcement is made in current issues of the *Age of Steel*, of St. Louis, and *Iron and Steel*, of Chicago, that the two papers have been consolidated under the name of the *Iron and Machinery World*, Willard A. Smith, president, and Bruce V. Crandall, secretary and treasurer. The consolidated paper will be published from Chicago. The Journal of Commerce Co., of St. Louis, in announcing this change, by which a familiar and epochal name passes from the list of iron trade journals, says that the *Age of Steel* had its beginning in 1857, when Robert M. Widmar established the weekly *Mississippi Handels Zeitung* (Journal of Commerce). In 1861 it was changed to an English paper, the *Journal of Commerce*. In 1878 the Journal of Commerce Co. bought the paper, and in 1880 changed its name to the *Age of Steel*. Wm. E. Barns, its highly esteemed editor, thus takes leave of iron trade journalism after a successful career. He continues to edit the St. Louis *Lumberman*, a thriving property of the Journal of Commerce Co., of which he is president.

MACHINE SHOP ARBITRATION AT PITTSBURG.

The differences existing between the machinists affiliated with the International Association of Machinists in the Pittsburg district and vicinity and the machine builders in that district, over the working system in the machine department of the Mesta Machine Co. at West Homestead, Pa., have not only been satisfactorily adjusted but the methods employed at the Mesta plant have been recommended by the committees as highly satisfactory. There is no minimum scale of wages governing the machinists employed in the Pittsburg district, and on June 30 last an agreement was entered into between the machinists and the employers which provided that a straight advance of 5 percent was to be made on July 1, and that any disputes that may arise in the shops of the parties to the agreement, shall, upon the request of either party, be taken up by the committees representing the parties to the agreement, each of which shall consist of five members. The decision by a majority vote of this joint committee of arbitration shall be binding upon both parties. Pending such decision there shall be no cessation of work by strike or lock-out, at the instance of either party to the dispute. It was under this last clause of the agreement that the existing differences between the two parties were adjusted.

When the new plant of the Mesta Machine Co. was placed in operation at West Homestead, Pa., owing to the high class of work coming into the shop, the question of having the machinists do a better grade of work, increasing their output and securing better care of their machines was taken up. After trying a number of methods, and looking into methods employed in various large machine shops throughout the country, the present system was adopted. By machinists outside of the Mesta shop who knew absolutely nothing regarding the workings of the system, it was called an attempted evasion of the premium plan. According to this system any new man engaged is paid at a rate mutually agreed upon with the foreman or superintendent of the shop. This rate is to be the base rate as long as the man is employed in the shop. If after a fair trial it is decided by the foreman or superintendent that the man is not worth the wages paid him the man only continues in the employ of the Mesta Machine Co. until a better man can be secured to take his place. This is done instead of reducing wages, as the officers of the company assert that they cannot possibly employ a poor man even if he agrees to work at one-half the rate agreed upon when he first entered their employ. If, however, any employe shows that he is endeavoring to increase the output of his machine, is doing his work accurately and satisfactorily and cares for his machine diligently, his wages are advanced from time to time according to his ability. The system worked to the satisfaction of the men in the shop, but when the union officials and others learned of it they demanded an investigation. In accordance with the agreement the committees representing the machinists and the machine builders had a meeting to settle the matter, but after going into the system in detail no agreement was reached, as the machine builders held that there was no violation of existing agreements while the machinists held there was. As the committees consisted of five members each there was a tie vote. It was then decided to call in a board of arbitration. John A. Brashear was appointed chairman of the board, and W. D. Johnston, a lumber dealer, was appointed to represent the machine builders, while the machinists were represented by C. A. Ainsworth. Testimony was taken by the arbitrators and a decision was reached in favor of the Mesta Machine Co. early Tuesday morning, Dec. 9. It was found that the system in vogue was in no particular a premium system and that no clauses of existing agreements were violated.

After the decision of the board of arbitrators was received a

meeting of the joint committees representing the machinists and the machine tool builders was held. By a unanimous vote they declared that the Mesta Machine Co. was not violating the agreement and further decided that they approved of the methods that were being introduced, as they considered them an improvement in shop conditions and that they would be the means of attracting the highest class of workmen throughout the United States to the Pittsburg district and into the shops where this system is in vogue.

At the hearing before the board of arbitrators, some of the machinists not employed in the machine department of the Mesta Machine Co. asserted that according to their belief the system in operation was to secure the greatest possible output and then to reduce the wages of the men accordingly. Testimony of men in the shop was that such is not the case and that ability is being well recognized by steadily increasing wages.

THE SITUATION IN THE PLATE AND SHEET MILLS.

While there has been some improvement in the sheet and tin plate trades a great many mills not only of independent concerns but of the American Tin Plate Co., and the American Sheet Steel Co. still continue idle. The American Tin Plate Co. has about 140 mills idle at the present time which is a trifle more than one-half of its capacity. Of the plants in operation a number have idle mills that have not yet been put into operation and unless the demand for tin plate increases there will be no resumption until after the first of the year. The Champion works of the company at Muskegon, Mich., is idle. Indiana Works, Elwood, Ind., have 12 mills idle and 14 in operation; Greer mill, New Castle, Pa., is idle; Shenango Works, New Castle, in partial operation; Humbert plant, Connellsville, Pa., idle; Pennsylvania plant, New Kensington, Pa., idle; Beaver Works, Lisbon, O., idle. The Laughlin plant at Martin's Ferry, O., which has been idle for a long period and which contains 23 mills resumed operations last week in full. Among the independents the plant of the Jackson Tin Plate Co., containing eight mills and located at Clarksburg, W. Va., is idle. Four mills of the Sharon Tin Plate Co., Sharon, Pa., are idle. Pope Tin Plate Co., Steubenville, O., has five mills idle.

Despite the fact that the tin plate capacity is already too great for the country's consumption, independent concerns have 47 mills under construction at the present time. The ten-mill plant of the McKeesport Tin Plate Co., McKeesport, Pa., will be placed in operation shortly after the first of the year. The Colorado Fuel & Iron Co. has ten mills under erection. The buildings for the ten-mill plant of the Rolling Mill Co., of America, at Morgantown, W. Va., are completed and the work of installing the mills has already been commenced. This plant will not be a factor in the tin plate trade for at least three months. At Mahan Station, W. Va., the Follansbee Bros. Co., has four mills under construction, while at Waynesburg and Washington, Pa., seven additional mills are under erection. At Greencastle, Ind., the Juniata Steel & Iron Co., has six mills under construction.

The sale of lots has been an important factor in providing funds for the erection of a few of these independent plants, and others only recently completed were largely built in this way. Some of the plants recently completed are in operation while the remainder are entirely idle or have a few mills on. The present price of tin plate makes the operation of a plant without its own supply of raw material unprofitable, and such plants will lose money, unless they have an outlet for their product in a connected industry, in which case the profits are made on the finished product of the latter, as in a number of instances.

In the sheet trade the proportion of independent mills idle is greater than that of the tin plate, while the proportion of the mills in operation by the American Sheet Steel Co. is greater. About one-sixth of the latter company's mills are idle at the present time. Among the independent sheet mills idle are those of the Waukesha Sheet Steel Co., Waukesha, Wis.; Zug & Co., Pittsburg; Waynesburg Forge, Sheet & Tin Mills, Waynesburg, Pa.; Whitaker Iron Works, Wheeling, W. Va.; Ashland Sheet Mill Co., Ashland, Ky., two mills idle; Youngstown Iron, Sheet & Tube Co., Youngstown, O., two mills idle; Parkersburg Iron & Steel Co., Parkersburg, W. Va., two mills idle; Muskingum Valley Steel Co., Zanesville, O.

In other finished lines the number of bar iron mills that are idle at present lead. The Republic Iron & Steel Co. has a number of mills idle, closed down, while the idleness of a number of mills in the East is largely due to the fact that sufficient coal cannot be secured to operate the plants.

REVISION OF IRON FREIGHT RATES.

Westbound rates on iron and steel have been revised in line with eastbound rates previously adopted. The new rates are as follows and are effective Jan. 1:

Pig iron, mill cinder and scale, car lots, on basis of $4.62 per gross ton, New York to Chicago. Billets, blooms, borings, crop ends, ingots, muck or puddle bars, old car wheels and axles, old rails, scrap iron or steel, scrap tin and slabs, car lots, on basis of $4.95 per gross ton, New York to Chicago. On ingot molds, car lots, on basis of $4.95 per net ton, New York to Chicago. On ferro-manganese, spiegeleisen, manganese ore, zinc skimmings or sal ammoniac skimmings (in packages), zinc, dross, zinc ashes, ferrosilicon, tin dross, lead dross and ferro phosphorus, car lots, on basis of $4.95 per gross ton, New York to Chicago.

On articles by the special iron tariff on basis of 33 cents, less than car lots and 27½ cents car lots, New York to Chicago.

From New York, with usual differences from other Eastern cities—

	Cents per 100 lbs. L. C. L.	C. L.
To New Orleans	55	48
To Memphis	42	35
To Nashville	40	34

The foregoing rates will apply, except where the regular tariff rate under the official classification is less.

The concurrence will be asked of the Memphis committee in the rates named to Memphis and Nashville, and of the Southeastern Mississippi Valley Association in those to New Orleans.

Between Pittsburg and	Cents per 100 lbs. Special iron list. C. L.	Special iron list. L. C. L.	Per gross ton. Billets, etc.	Pig iron, etc.
60 per cent points and				
New York	14½	17½	$2.60	$2.40
Philadelphia	13½	16½	2.40	2.20
Baltimore	13	16	2.30	2.10
Boston	16½	20	3.00	2.80
Between Buffalo and				
New York	14½	17½	2.60	2.40
Philadelphia	14½	17½	2.60	2.40
Baltimore	14½	17½	2.60	2.40
Boston	16½	20	3.00	2.80

The rates on billets will apply on the following articles in carloads: Billets, blooms, borings, crop ends, ingots, muck or puddle bars, old car wheels and axles, old rails, scrap iron or steel, scrap tin and slabs per gross ton, and ingot molds per net ton. Also on the following articles: Ferro-manganese, spiegeleisen, manganese ore, zinc skimmings or sal ammoniac skimmings (in packages), zinc dross, zinc ashes, ferrosilicon, tin dross, lead dross and ferro phosphorus per gross ton.

From Pittsburg to—	Cents per 100 lbs. Iron and Steel Articles. C. L.	L. C. L.	Billets, etc.	Pig iron, etc.
Burlington, Vt.	19½	23	$3.60	$3.40
Albany	14½	17½	2.60	2.40
Utica	13½	16	2.40	2.20
Syracuse	12	14½	2.20	2.00
Rochester	10½	12½	1.90	1.70
Buffalo	10	12	1.70	1.65
Virginia cities	18	22½	2.80	2.60

Pig iron, mill cinder and scales, car lots, from Lebanon, Harrisburg and Steelton, Pa., to Pittsburg, $2.10 per gross ton. Billets (only) car lots from Pittsburg to Trenton, Phillipsburg and High Bridge, N. J., $2.50 per gross ton. Car wheels, not attached to axles, in carloads, from Buffalo to Paterson, N. J., 13 cents and to Schenectady, 10 cents per 100 pounds. Scrap iron in carloads from Wilkes-Barre, Scranton and Carbondale to Montreal, $3.50 per gross ton; Olean and Bradford to Erie, per gross ton, $1.60; to Cleveland, $1.95; to Mahoning and Shenango Valleys, $1.95.

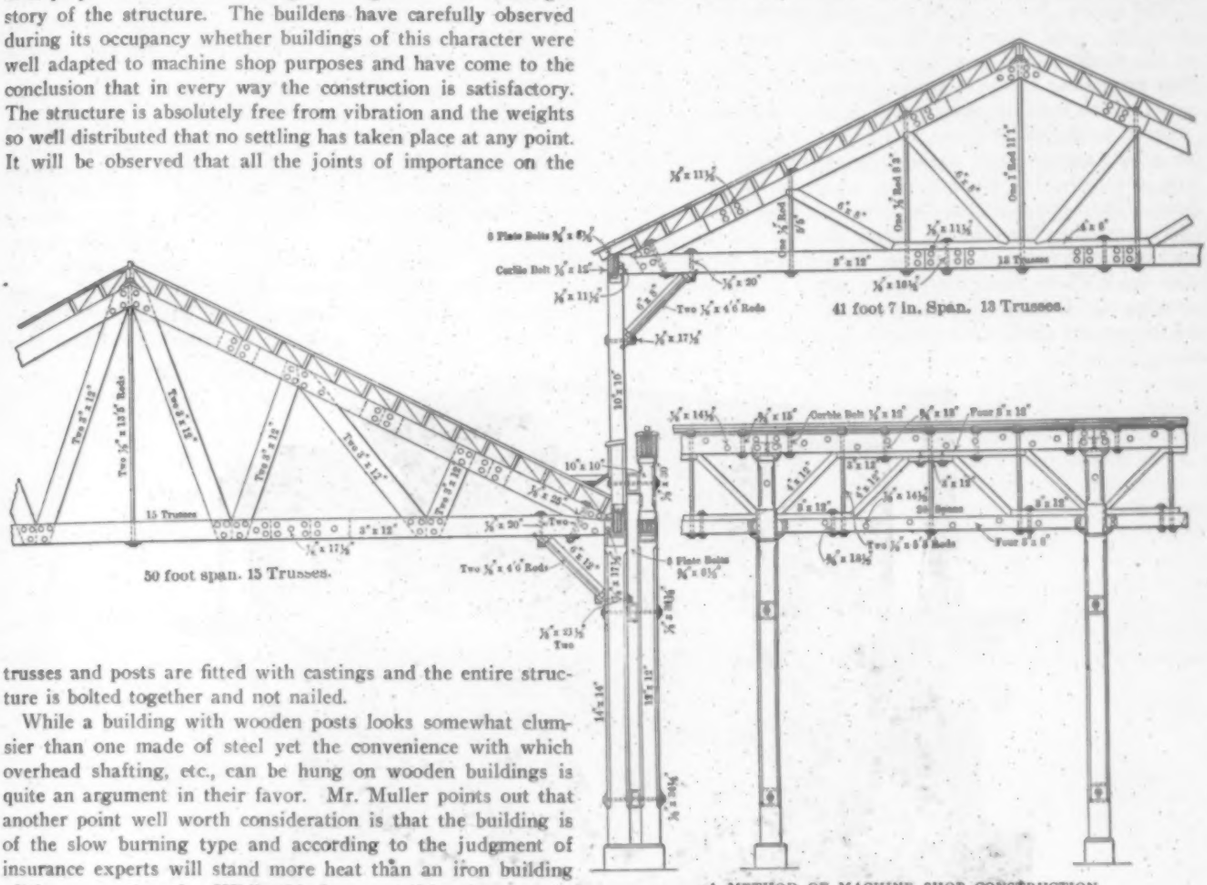
It is the understanding that the advanced billet rates will be made effective on Jan. 1 between the specific points to and from which carload billet rates are authorized on the following articles in carloads: Tin plate bars, sheet bars, pipe iron or pipe steel in lengths of 12 feet or over (to be used in the manufacture of pipe), wire rods in coils, unfinished, not drawn through a die, chain iron in coils and not drawn through a die.

It has been announced at Youngstown, O., that no attempt will be made to place the Haselton furnace of the Republic Iron & Steel Co., Haselton, O., in operation until after the first of the year. The mill at this place will also be idle until that time.

A METHOD OF MACHINE SHOP CONSTRUCTION.

The machine shop building of the Springfield Machine Tool Co., of Springfield, O., was completed in the spring of 1900 and has therefore been occupied for a period of two and a half years. It was essentially a machine shop job and was designed and built under the supervision of the present superintendent of the plant, E. A. Muller.

The peculiarities of the construction are well set forth by the engraving which illustrates the double span of the two halves of the shop, in longitudinal and transverse elevation. It is prepared from the working drawings and tells a straight story of the structure. The builders have carefully observed during its occupancy whether buildings of this character were well adapted to machine shop purposes and have come to the conclusion that in every way the construction is satisfactory. The structure is absolutely free from vibration and the weights so well distributed that no settling has taken place at any point. It will be observed that all the joints of importance on the trusses and posts are fitted with castings and the entire structure is bolted together and not nailed.



A METHOD OF MACHINE SHOP CONSTRUCTION.

While a building with wooden posts looks somewhat clumsier than one made of steel yet the convenience with which overhead shafting, etc., can be hung on wooden buildings is quite an argument in their favor. Mr. Muller points out that another point well worth consideration is that the building is of the slow burning type and according to the judgment of insurance experts will stand more heat than an iron building of the same strength. While this latter consideration may be debatable there is no doubt whatever about the success of the arrangement in practice and it offers an excellent example of the intrusion of the mechanical engineer into the field of architecture.

There is, however, no reason for considering the machine shop building as any less or more than the frame of a piece of machinery and from this standpoint the engineer rather than the architect should rightly have the function of adapting the structure to the best needs of manufacturing than the minor detail of pleasing the eye. On the general principle that what is right will look right, the skilful engineer is apt to meet this latter demand also.

A report just issued by the United States Geological Survey makes some interesting comparisons. In round numbers, says the report, the value of the gold product of the United States for 1901 was $78,000,000, and of the silver product the value was $71,000,000 as money (coining value), and $33,000,000 as metal (commercial value). As metals, then, gold and silver products were valued at a little less than $112,000,000; as money, they were worth $150,000,000. The corresponding figures for 1900 were $115,000,000 and $153,000,000—a loss for 1901 of more than $3,000,000. Iron ore and its products increased notably in quantity, but decreased in still greater proportions in value in 1901 as compared with 1900. Yet, notwithstanding a loss of nearly $18,000,000 in value as compared with 1900, the pig iron produced in 1901 exceeded the metal value of the gold and silver by $130,000,000, and their combined coining value by $95,000,000.

INTERSTATE ENGINEERING CO.

The Interstate Engineering Co., of Cleveland, has been incorporated by C. A. Klump, Paul Schneider, Martin Mullen, I. W. Kaltenbach and Justin Griess, Jr., with a capital of $300,000, and will add another to the several large plants already erected or in course of construction, which have made Cleveland an important factor in the manufacture of conveying and hoisting machinery and other equipment for large plants. Messrs. Kaltenbach and Griess have long been associated as engineers and have had a large business, but have not engaged in manufacturing.

The new plant will be located on the Pennsylvania Railroad, about 12 miles from Cleveland and half a mile from Bedford, O. The plans call for the erection of a structural shop 160 by 600, two machine shops 120 by 400 feet, a forge shop 120 by 400 feet, an erecting shop 80 by 200 feet, a power house, office building and other minor buildings. Most of the buildings are to be so built as to admit of their being enlarged to meet future demands. It is not proposed to begin work on all of these buildings at once, but to start in a modest way and gradually carry out the plans. The site consists of 40 acres favorably located.

Iron and Steel Works for India.

Newspapers have recently spoken of the project of Mr. Tata to build blast furnaces and steel mills in India, saying that $12,000,000 will be spent, that a great amount of machinery will be bought, etc. This is all premature. Mr. Tata has recently been in the United States making careful investigations, and Mr. C. P. Perin, consulting engineer, New York, has been helping in his studies. Mr. Perin is now sending an engineer to India to examine the properties there and make further reports to Mr. Tata. It is likely that something important will come of all this, but up to the present time nothing has been decided and nothing will be done immediately.—[Railroad Gazette.

The A. & J. Stove Foundry, Gadsden, Ala., contemplates doubling the capacity of its plant.

SCALE CAR FOR BLAST FURNACE MATERIALS.

Several view are given herewith of a specially constructed ore charging Scale car, built at the Lebanon, Pa., works of M. H. Treadwell & Co., 95-97 Liberty St., New York. This car is used in connection with a blast furnace bin system in the handling of the stock—iron ore, limestone and coke. The car runs on a track directly in front of the stock bins, from which the stock is dropped into the car and weighed automatically, either in part or as a whole, before being delivered to the skip car which carries it to the top of the furnace.

The special feature is the five-beam standard Fairbanks scale, the metal beam box for which is located at the side of the platform and at all times accessible to the operator. The propelling power is derived from the electrical equipment which consists of two 30-h. p. Westinghouse motors secured to the under frame and geared direct to the axles, on which are mounted 30-inch diameter wheels. The electric controller on the platform is of the Westinghouse type. The current is supplied from overhead trolley wires. To release the charge in the hopper the lever shown on the end is moved forward, which in turn releases the door and the stock slides from the hopper which is tapering, preventing the lodgment of any material on the inside edges of the car and discharging the entire contents on the one side

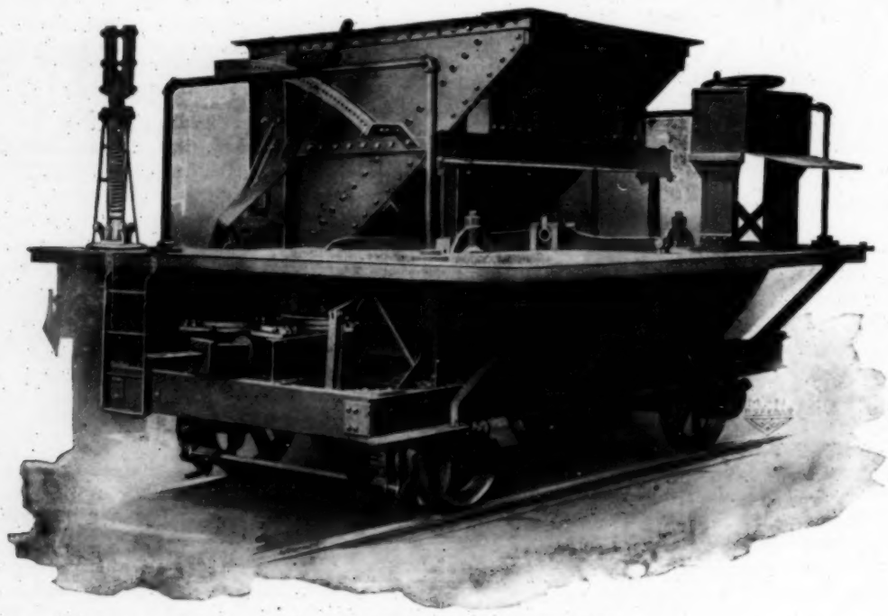


FIG. I.—SCALE CAR FOR BLAST FURNACES.

only and clear of the track. The car is thus left clear and ready for a new charge.

The car is of extra heavy steel construction and such as to meet the particular requirements of this work. The hopper is of steel plate construction having tapering sides, the bottom sloping toward the front at an angle of 45 degrees. The door extends the full width of the hopper and can be raised gradually or instantly the entire extent of the opening, precluding any fouling of the stock. The body is made of standard steel shapes braced to resist undue shocks and strains, and on it is the platform for the operator. The car is equipped with brass bearings and cast iron chilled wheels 26 inches in diameter and draw bar couplers of malleable iron. The features of the car are the ready charging and automatic weighing, ease of propulsion and release of the charge, all accomplished by one operator. Cars of this type are in use at several blast furnace plants. They are constructed of various gauges and capacities. The car illustrated is of standard gauge, 4 feet 8½ inches, has a capacity of seven tons, weighing loaded 12½ tons.

The first shipment was made a few days ago from the new plant of the West Virginia Bridge & Construction Co., Wheeling, W. Va.

MALLEABLE CAST IRON.*

BY H. E. DILLER, CHICAGO.

Much has been written of late in the way of calling attention to the rapid growth of the malleable casting industry, and, indeed, not only are new works springing up in the large iron centers, but the older establishments are expanding very materially. There is little wonder at this when it is considered that the malleable casting is peculiarly adapted to the requirements of four great classes of work; agricultural implements, railway supplies, carriage and harness castings, and pipe fittings. Were it not for the fact that malleable cast iron is not adapted to the heavier sections, it would be a sharp competitor to the gray casting industry.

In its manufacture the special make of iron called "malleable Bessemer," or "malleable coke iron," is the principal material used. The charcoal irons, though unequalled for value, being confined to the regions where they can compete with the cheaper coke irons. The silicon should be .75 to 1.50 percent, phosphorus under .200 percent, while sulphur should be below .04 percent if possible. A pig iron, higher in sulphur, in reality an off-Bessemer, while meeting the silicon specifications perfectly, should not be used except in limited quantity, and then carefully watched. With the pig iron, hard sprues (unannealed scrap), steel and also malleable scrap is charged. The latter two materials are very good to add to the mixture as they raise the strength of the casting very considerably. Care must be taken not to add too much, as this reduces the carbon to a point where fluidity and life in the melted metal is sacrificed.

Malleable is produced in the cupola, the reverberatory furnace, and the open-hearth furnace. The first process, under ordinary conditions, is the cheapest. The iron made, however, is by no means the best. Test bars made of cupola iron seldom run above 40,000 pounds per square inch, while with furnace iron there is no difficulty in getting a few thousand pounds more. The most serious objection to cupola iron is its poor behavior under the bending test, the deflection being very light.

In the reverberatory and in the open-hearth furnace, the fuel is not in contact with the metal and the result is much more satisfactory. The metal in these furnaces may either be caught in the ordinary hand ladles or it is tapped into a large crane ladle and conveyed to the distributing point and there emptied into hand ladles as required. When tapped into hand ladles, the time taken is a serious item, for the beginning and the end of the heat will be two differ-

*Written for the Journal of the American Foundrymen's Association.

ent things. The latter iron especially will be inferior, as it was subjected to the oxidizing effects of the flame much longer than the first part. As a rule this difficulty is somewhat remedied by pouring the light work first, the heavier pieces coming later, when the silicon has been lowered too much for good light castings. With the crane ladle pour the molder has much less space to travel over, and this will doubtless be the coming method.

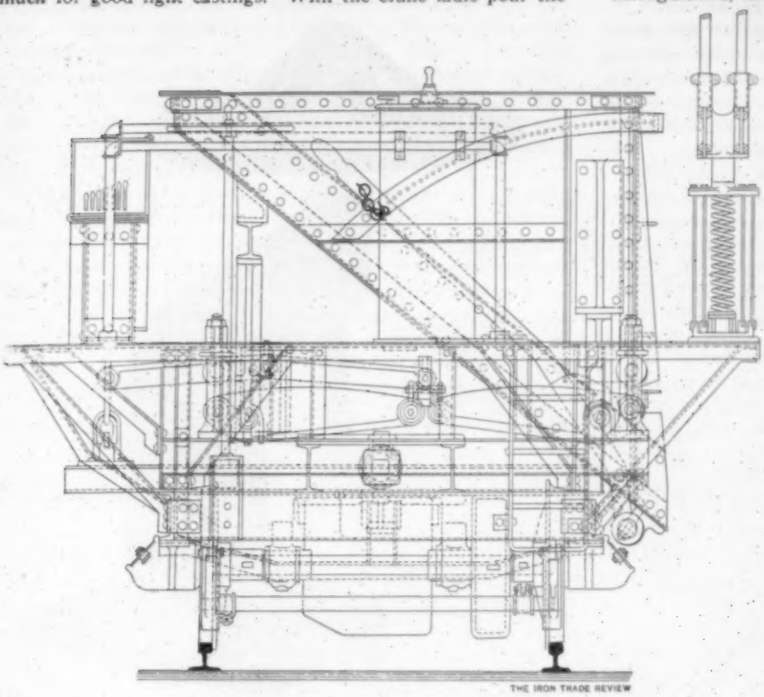


FIG. 2.—END ELEVATION OF SCALE CAR.

It takes a good man in the foundry as well as in the pattern shop to handle malleable casting questions properly. The gating should be done to avoid the shrinkage effects as much as may be, while the little tricks that can be appled make a surprising difference in the molding loss. As a consequence some malleable works seldom lose more than 10 percent, while in others 20 percent and over is the rule.

After the castings have been tumbled they go to the annealing room where they are packed in mill cinder or iron ore, in cast iron boxes. These are carefully luted up, and heated up in suitably constructed ovens for the space of five or six days. It usually takes 36 to 48 hours to get the oven up to heat, the temperature ranging from 1,600 to 1,800 degrees F. in the oven, the boxes having a somewhat lower temperature at the coldest point. When the fire is extinguished, the dampers are closed tight, all air excluded and the oven allowed to cool very gradually, often but 400 degrees F. the first day. After the castings come from the anneal, hey are again tumbled to remove the burnt scale, and they are chipped and ground for shipment.

The hard casting should have its carbon practically all in the combined state, while the annealing process should convert this to the so-called temper, or annealing carbon. A well annealed casting should not have much over .06 to .12 percent combined carbon remaining in it. Under-annealed castings can be readily detected by their brittleness, but it takes much experience to be sure that a casting is over-annealed. There is a material difference between the strength of an over-annealed casting and a normal one. I took two bars from each of five heats. One bar from each set I gave the usual anneal; and the others I reannealed. The average tensile strength of the first set was 50,520 pounds per square inch, and the average elongation was 6¼ percent in 6 inches. The reannealed set had an average tensile strength of 43,510 pounds per square inch, the average elongation being 6¼ percent in 6 inches. Over-annealing had therefore cost the metal some 7,000 pounds of its strength.

The fact that malleable castings are little understood may account for the limited way in which they are specified. While some railroads specify the mixture, composition and strength of gray castings, they do little in the way of the malleable. One railroad for which I made castings called for 40,000 pounds per square inch, and an elongation of 5 percent in two inches, for section ½-inch and under, and 30,000 pounds per square inch with a corresponding elongation of 2½-inch for sections ¾-inch to 1-inch thick.

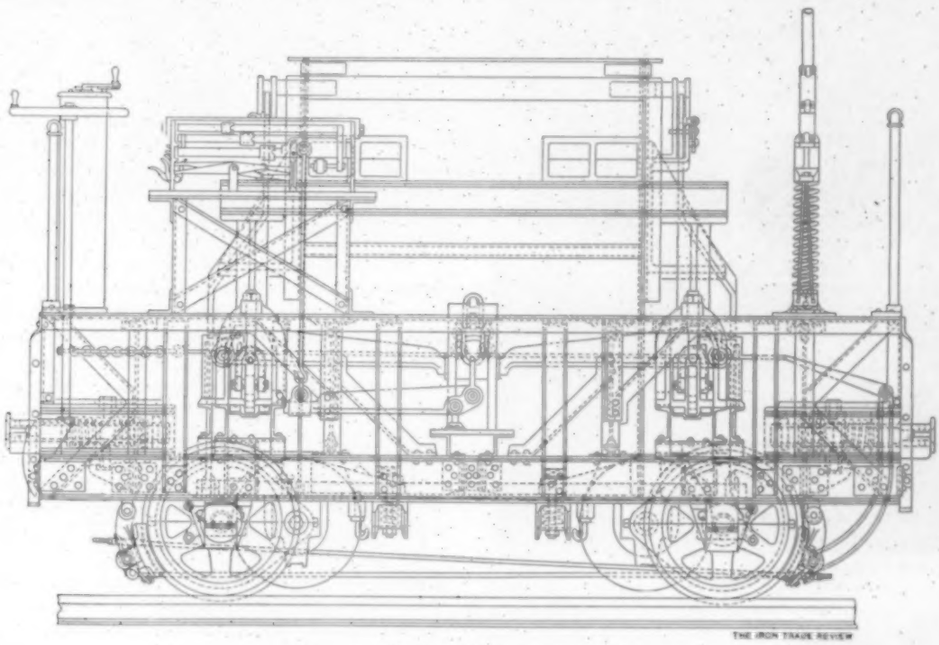


FIG. 3.—SIDE ELEVATION OF SCALE CAR.

To show to what degree some foundries are making iron for these demands, I took test pieces from some of their castings. The tensile strength and elongation, in six inches, of these pieces was as follows:

No. 1. 35,030 lbs. per sq. in., and 4.7 percent elongation.
No. 2. 34,410 lbs. per sq. in., and 3.3 percent elongation.
No. 3. 37,840 lbs. per sq. in., and 4.2 percent elongation.
No. 4. 45,550 lbs. per sq. in., and 4.0 percent elongation.

It was also rather odd that the thicker pieces showed the better iron, for usually founders err in the pouring of heavy castings with mixtures intended for light work.

Malleable can be made up to 60,000 pounds per square inch, though this is not advisable as the shock resisting qualities are sacrificed. Yet as specifications become more severe the general quality of this class of castings will be improved until we get a more reliable article, which can better resist the encroachments of the steel casting.

DOCK CONVEYOR.

The illustration shows a recent installation of an endless apron carrier on the dock of the Old Dominion Steamship Co., of New York City, and is in daily operation for the handling of packages and promiscuous freight. The large steamship docks often have two stories and are double decked, and in such cases the upper deck is used for storage of freight, while the unloading from the steamships is very greatly facilitated and the freight delivered to the upper deck of the dock by means of such a conveyor as the one illustrated. The conveyor proper consists of two heavy chains, with rollers at each ling, carrying wooden cross pieces, the whole forming an endless apron, on which any box or form of package can be readily placed, and delivered to the elevation at the head of the carrier. With various modifications of this type it can be arranged to operate directly in the gangway leading from both holds in the side of the ship, and when so placed is pivoted at the upper end, while the out-board end is made adjustable to accommodate the different heights of the ship at various tides; it always being possible to keep the carrier on a level with the ship's deck from which the freight is being taken.

Carriers of this class may be operated by steam or electric power, and when necessary they can be made portable, that is, built in truss shape and self-contained, carrying within the frame an electric motor by which they are driven. The builders are the Jeffrey Mfg. Co., Columbus, O., and 41 Dey St., New York.

A DOCK CONVEYOR.

The report on the practical operation of the national bankruptcy law for the past year makes a remarkably good showing for manufacturers. Of the cases closed during the year 1,320 were in behalf of farmers, 6,859 wage workers, 2,585 merchants, 235 manufacturers 531 professional men and 1,758 contractors, hotel and saloonkeepers, real estate men and others of a miscellaneous character not included within the classes enumerated.

NEW YANKEE ARBOR AND STRAIGHTENING PRESS.

This is a press for the machine shop work of driving lathe arbors and straightening but because it has a screw it should not therefore be confounded with the ordinary screw press in which most of the power is lost in friction and the action is provokingly slow. It has a coarse pitch, double threaded screw and a hand wheel with a heavy rim the inertia of which is utilized to force the arbor tightly into the bore of the work. The combination is effective in the production of a driving effect as great as with a sledge but without the destructive battering of the ends and centers of the mandrils. The inertia of the hand wheel is employed for the purpose of giving the arbor two or three final impulses after it has been forced down as far as can easily be done by turning the wheel in the usual manner, the leverage being 47 to 1. It should be understood that the thread is of so coarse a pitch that the screw will never lock on the work and when turned down quickly on a tight fitting mandril will be repelled and turn in an opposite direction.

YANKEE ARBOR AND STRAIGHTENING PRESS.

The arrangement of jaws on the anvil to accommodate different diameters of mandrils is noteworthy. They open and close in unison so that the work is always central under the screw and arbors can be readily forced into and out of thin bushings.

To straighten shafts the jaws are opened some distance and the pressure applied centrally between them. With one hand on the work and the other at the wheel rim, the ram may be brought down with an easily gauged force and the work quickly straightened with a minimum amount of injury to the surface. The press would seem to have a valuable field for the handling of light work especially. Hardwood strips are inserted in the bottom so that when bolted to a lathe bed no damage will be done to the ways and lugs keep the press forward to prevent arbors marring the front edge. The machine is equally well adapted for bolting to a bench.

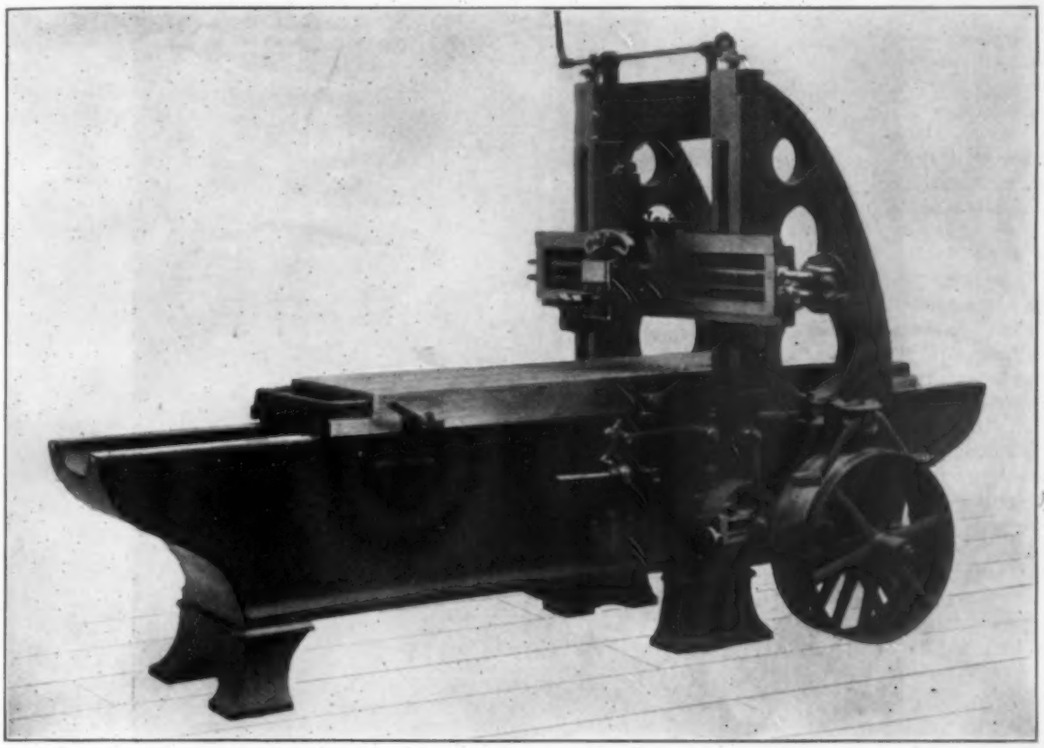
The press will take work up to 14 inches, is designed for service on a range of arbors up to 2 inches, and is manufactured by the Wilmarth & Morman Co., of Grand Rapids, Mich.

The O-Rib-O Club, of Detroit, was opened last week by the officers and employes of the Briscoe Mfg. Co., of that city, maker of sheet metal goods and rural mail boxes. The company has donated the use of a two-story brick house, which is fitted up with conveniences, such as reading room, baths, gymnasium, fully equipped kitchen and dining room. Members will lunch at noon at the club.

LATE TYPE OF 24-INCH PLANER.

The illuistration accompanying shows the latest "American" 24-inch planer brought out by the American Tool Works Co., of Cincinnati, builder of lathes, planers, shapers, upright and radial drills. This planer is new from the drawing room up. The bed is deep and unusually long, giving the table almost a full bearing when planing at extreme length. The Vs are wide, with oil pockets at short intervals, to insure thorough lubrication to the table. The housings are of box form with wide face. The cross rail, which is well supported on the back and bolted to the housings, can be raised or lowered from either side of the machine.

The table is heavy and has T slots planed its entire length. Holes are drilled and reamed from the solid. The head has a bearing on the cross rail, and has automatic cross, vertical and angular feeds. An improved shifting device removes one belt from the tight pulley before the other engages it, doing away with any shrieking of belts. The back dog is so arranged that the table may be run from under the tool for examination of work, and is provided with rollers to avoid the wearing caused by constant rubbing of friction. The bull wheel is stationary on its shaft. The latter revolves in long bearings of large diameter easily oiled. This construction obviates the difficulty of running the table back to oil the bull wheel. The driving shafts are made of special hammered steel, and each shaft with all its parts can be easily removed when necessary.



24-INCH AMERICAN PLANER.

METAL-WORKING MACHINERY CENTERS.

A report which has just been submitted to the census bureau by Edward H. Sanborn, expert special agent, contains a vast amount of information concerning the manufacture of metal working machinery. Ohio is the leading State in the manufacture of this kind of machinery. Within the past decade there has been a marked tendency toward specialization, particularly among the new establishments that have started business in recent years. Most of the older manufacturers of machine tools, whose business runs back for 20 or 30 years, produce a variety of machines, in some cases embracing nearly everything required for the equipment of a new shop. In late years, however, manufacturers starting in this branch of industry have very generally limited their operations to the production of a single type of machine, or, at the most, to one class, embracing tools of similar types. Philadelphia is one of the largest of machinery centers; 11 establishments reported an aggregate product of metal working machinery valued at $3,095,574. These products include a wide range of tools with less of the specialization that is characteristic of Cincinnati and other localities where the industry is of more recent growth. Providence, R. I., ranks third in the manufacture of metal-working machinery, the product of 14 establishments amounting, during the census year, to $2,929,141. Here, again, the industry is diversified rather than specialized. A large amount of automatic and semi-automatic machinery, such as screw machines turret lathes, and gear cutters, and also milling machines of various types, are made in Providence, and these might be said to be the chief characteristic of the industry. Hartford, Conn., stands next to Providence, and shows about the same features in the machine-tool trade, with a wide range of products, among automatic and semi-automatic machines might be mentioned as most significant. During the census year 11 establishments in Hartford reported the production of metal working machinery to the value of $2,796,935. Worcester, Mass., is another important center for the manufacture of machine tools, with much of the same specialization that is manifest in Cincinnati. Twenty-four establishments reported for the census year products aggregating $2,009,357 in value. Engine lathes are one of the specialties in Worcester, and of these 2,667 were made during the census year. These, with the 3,924 made in Cincinnati, embrace more than one-half of the entire number of engine lathes made during the census year. Drilling machines of various types, particularly small sizes, are another important item in the Worcester products, 4,552 of these having been made during the census year.

The effect of this specialization in the manufacture of metal working machinery has been manifest in the improvement of the product and the economy of its manufacture. With but few exceptions, it may be said that the general tendency of machine tools has been toward more efficient machines rather than in the direction of lower prices.

The Enterprise Foundry & Equipment Co., Harvey, Ill., will erect a new pattern shop, 24x40 feet.

FILING SYSTEM FOR OFFICE USE.*

BY HENRY M. LANE, SCRANTON, PA.

1. The filing system described in this paper has been the result of a number of experiments, the object to be attained being the preservation of catalogues, clippings, engineering data, photographs, etc., in such a way that they can be used either for general engineering work or in connection with the writing and editing of engineering work. So far as possible, standard devices which can be purchased on the market have been used. In one of the systems which the writer used for a number of years he had a large collection of letter files upon which various titles were placed and then the material corresponding to the title was placed in the files. This system presented the following difficulties: There was a large amount of dead space, owing to the fact that some of the files were filled up rapidly and others very slowly. Also when the files became full it was necessary to add others having the same title, and these were usually located a considerable distance apart. In this system no card index was used, the titles on the backs of the files being depended upon entirely. In such a system as this, in order to consult the files intelligently it is necessary to have a knowledge of their irregularities, such as duplicate filing cases having the same title located at different points of the system, etc.

When the present system was started all previous arrangements were discarded. As the system now stands it comprises an ordinary Wells filing case, as shown at *a*, Fig. 1, and three sectional units, such as are furnished by the Globe-Wernicke Co., two, *e* and *f*, being ordinary letter-box files, and one, *d*, a pigeon-hole unit. Under the sectional units there is simply a rough board cupboard, *g*, the use of which will be described later.

When a catalogue is received, it is examined, and if it is desired to file it, the various subjects which are to be indexed are underscored. In many cases only the firm name and the principal subject require underscoring, as, for instance, in the diamond drill catalogue of the American Diamond Drill Co., I underscore the word "American" in the firm name and the word "diamond." After this the catalogue is handed to an assistant, who makes out two cards which go in the card index. One of these is filed under "American" and the other under "diamond.' If it were desired to be more explicit the word "drilling' would also be underscored, a third card being headed "Drilling, Diamond" and the card filed in its proper place in the index.

The advantage of this system is that if it is desired to replace a catalogue or destroy one at any time it is easy to tell just what cards there are in the card index which refer to the catalogue, and these can be taken out and altered or destroyed as desired. The difficulty with many filing systems is that there is no way of tracing back to the cards from the catalogues, but in this one, before the cards are made out the catalogue is assigned to its proper place in the filing system. No attempt whatever is made to file catalogues by subject, but each one is given two designating numbers or a designating number and a letter, the catalogues being filed according to size. For instance, the catalogue above referred to might be designated as "326—5," indicating that the catalogue belonged in compartment 326 and that it was the 5th in that compartment; the card referring to this catalogue being marked correspondingly 326—5 in the upper left-hand corner.

FIG. 1.—FILING SYSTEM FOR OFFICE USE.

When looking for information it is only necessary to consult the card index and find what catalogues or other information are required, then to take a scrap of paper and place the proper numbers upon it, and hand it to an assistant, who can obtain the catalogues from the case. When through with the catalogues they can be returned to their proper place in the files without consulting the card index owing to the fact that the locating numbers have been placed in the upper right-hand corner of the catalogue.

Any catalogue which is thick enough to stand in the compartment is filed in this way. Photographs, letters, clippings, or small circulars are filed in the regular filing portfolios shown in the lower portion of the filing case *a*, Fig. 1, and one of which is shown in the supporting rack of the left-hand door of the cabinet at *b*. Attention is called to the two supports which are placed upon the doors of the cabinet, the one at *b* for holding portfolios while examing the materials which they contain, and the one at *c* for supporting flat books while being examined. Both of these

*Read at the New York meeting (Dec. 1902) of the American Society of Mechanical Engineers.

shelves or supports are arranged so that they drop out of the way when the cabinet is closed. The portfolios each contain twenty-five spaces, which are numbered from 1 to 25, and the consecutive portfolios are given serial numbers so that anything which is located in one of them can be found by two designating numbers as in the previous case.

At first is was quite a problem how to extend this system so as to cover the filing of drawings, blue prints, etc.; but the solution has been found in the pigeon-hole boxes in the Wernicke cases shown at *d*, Fig. 1. Manila paper folders are made to contain the drawings, the paper being cut as shown in Fig. 2; a tin form of the proper dimensions is laid on as indicated by the dotted lines, after which the three flaps are folded over the tin form and creased down. Each one of the pigeon-hole boxes is given a number, and the folders which it contains are numbered consecutively from 1 up, so that everything in one of the pigeon-hole boxes can be found by means of the two reference numbers; a large amount of matter such as specifications, small pamphlets, circulars, small catalogues, folders, etc., being filed in this way in addition to the blue prints and drawings. The title of the material which is filed in each folder is written on the back of the folder with words underscored corresponding to the words on the index cards. The regular letter-file units are used for photographs and

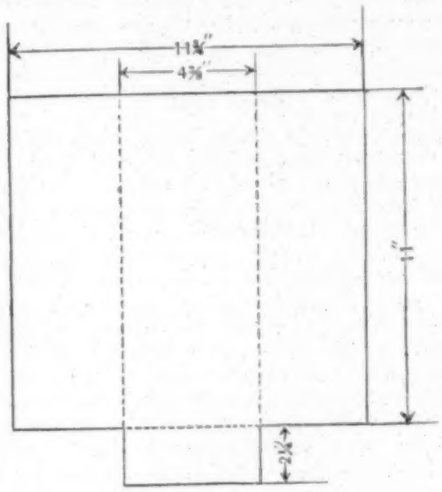


FIG. 2.

similar material, though it would be possible to get along without them by having more of the portfolios as shown in the lower portion of the Wells cabinet, Fig. 1.

This system works admirably for uniform-sized catalogues, but odd sizes give more or less trouble. Large thin catalogues have been folded up and filed in the pigeon-hole boxes or in the letter files, but large catalogues of irregular size with stiff binding have proved a source of considerable annoyance, and in some cases have been ruthlessly destroyed on account of the fact that it was impossible to file them advantageously. Large bound catalogues are given serial numbers as in the ordinary library index and are kept on top of the Wells cabinet and on suitable shelves, which are not shown in the illustration.

A few words concerning the card index which accompanies this may be of interest. The first idea was to have the card index placed in one of the units of the Wernicke sectional files, but in order to protect the index from fire losses a set of ordinary drawer files was finally adopted. At present the writer has six of these files in use. The cards are 2 by 5 inches. In the upper left-hand corner are entered the two figures, or figure and letter, corresponding to the place in which the catalogue or other material is filed. The upper line of the card contains the title corresponding to the underscore in the catalogue for which the card was made out. Frequently some additional information concerning the catalogue is entered on the card, and in many cases where it is desired to file some small bit of information, such as a formula, the information is all entered upon the card, at times the back as well as the front being utilized for this purpose. In such a case as this no reference letters of course are necessary, as the card itself contains all the information.

As the system grew it became quite a task to look through the large accumulation of cards to find any given subjects, hence the use of auxiliary guide cards was adopted. For instance, under the letter M the ordinary subjects were filed in consecutive order, Ma, Me, etc., but it was found that there were many cards headed "Machinery," "Milling Machinery," etc., so that the idea of separating these and placing them at the back of the M file, just forward of the Ns, giving each a separate guide card, occurred to the writer. For instance, the M series in the index at present is arranged as follows: The miscellaneous M's occupy about 125 cards; back of this there is an auxiliary guide card headed "Machinery," under which there are about 75 cards; next a card headed "Milling Machinery," with about 50 cards; then one headed "Mining Books," with about 25 cards; one headed "Mining Laws," with about 25 cards; one headed "Mining Matters, Miscellaneous," with about 60 cards; one headed "Mining Machinery," with about 40 cards; one headed "Mining Schools," with about 30 cards. These auxiliary cards reduce the number it is necessary to look over to find any ordinary subject, and they facilitate the location of any matter relating to the special subjects covered by the guide cards most often consulted, as a man would naturally divide his work according to his wants, and the cards for the specialties which he needed would accumulate more more rapidly than others.

Another advantage of having the card index in these drawer files is that, in case the regular system should be destroyed by fire, a clerk or stenographer could replace a great deal of the matter by simply writing for the necessary catalogues and information and arranging them in new filing cases; it is probable that at least 60 percent of the matter in the writer's files could be replaced in this way.

A feature of this filing system is the rough set of shelves shown at *g*, Fig. 1, on which are arranged a series of envelopes containing pamphlet copies of the papers read before the American Society of Mechanical Engineers and the American Institute of Mining Engineers. In many cases both the preliminary and revised papers are kept, being simply placed in envelopes and arranged according to meetings. Any one of these can be found very quickly, the regular index and bound volumes being used to locate the original paper and find out at what meeting it was read, after which, by a reference to the envelopes, the pamphlet paper can be located.

At a meeting of the American Institute of Electrical Engineers on Nov. 21 in New York City, the topic was "Variable Speed Control for Electric Motors," particular attention being paid to the adaptation of the motor for driving machine tools. Papers were read by Messrs. Fowler, Coho, Keilholtz, Blackwell, Leonard, Storer and Lozier. Different methods were described by means of which a variation in speed of the electric motor to meet the requirements of the machine shop might be attained. In the discussion following, Mr. Charles Day called attention to the fact that the motor question was only one side of a most comprehensive problem which confronted the manufacturer who wished to increase his shop efficiency. He cited instances where the introduction of motor drives into the machine shop had not resulted in the economies expected, simply because the other elements had not been considered. With the introduction of the new tool steels, higher cutting speeds and feeds were possible and in many cases the old tools were not strong enough to stand these high speeds. To obtain the maximum shop efficiency, not only must the motor question be considered in connection with the tool and the tool steel to be used, but the nature of the material to be machined enters into the problem. In conclusion, Mr. Day told of an investigation he had carried on with his associate, Mr. Kern Dodge, into the methods of modernizing the machine shop.

The Headford Brothers & Hitchins Co., of Dubuque, will put in a foundry at Waterloo, Iowa.

RECENT PRACTICE IN MACHINE TOOLS.

BY JAMES K. CULLEN, HAMILTON, O.

Although there are records of lathes in the early part of the 16th century, the antiquity of machine tools is not great, but the information we have relative to their origin is extremely limited. Little more than a hundred years ago there were in existence only a few rude specimens of machine construction, among the number being tilt hammers, mills (so-called) for boring cannon, and engines (as they were then known) for cutting the teeth of clock-wheels.

As the efficiency of any machine is determined by the quality and quantity of its output, modified to an extent by the skill of the workman and the cost of operation, the designer must be familiar with the details of the various lines of manufacture in which it may be employed. He must also possess a theoretical knowledge of the properties of materials, coupled with a very broad practical experience. His labor is somewhat lightened on account of the comparatively limited number of methods employed in removing surplus from, or changing the form of, materials of different kinds. Rolling, forging, pressing, planing, turning, milling, grinding, drilling, tapping, punching, shearing and sawing, cover the most important; and all machines for effecting these operations can virtually be classified under one or the other heading.

The most noticeable feature in recent years in machine design is the immense increase in strength and power, and the introduction of cutting steels having lasting properties under excessive speeds and feeds that appear phenomenal, will make it still more pronounced. From 50 to 100 percent increase in power with proportionate additional strength is now not unusual to provide for cutting speeds of 40 to 75 ft., and the limit is not yet in sight.

The very first tool specially designed and built to meet the new conditions was a driving-wheel lathe furnished the Altoona shops of the Pennsylvania R. R. Its swing was sufficient to turn tires 52-in. to 68-in. on the tread at speeds ranging from 10 ft. to 30 ft. per minute. It is driven by a 25-h. p. variable speed motor, connected to the gear train by a magnetic clutch. The clutch is so constructed that the current can be passed from the end giving the speeds mentioned to the opposite end, where a reduction to 4 ins. is obtained, this being used to cut out hard spots. The changes are instantaneous and made by the operator simply throwing a switch. A 3-h. p. motor is attached to the end of the bed for adjusting the righthand headstock. The gears are all cut and are of gun iron and steel. The main spindle bearings, 13 ins. diameter, 16 ins. long, are of high grade bronze, and the internal sliding spindles, of steel forgings, 0.45 percent carbon, 7 ins. in diameter. The power and strength are sufficient to give a pressure of 18,000 lbs. at each tool, which is as much as the steel will stand. The carriages and tool rests are of the most substantial construction and capable of resisting the enormous strains that are imposed upon them. The weight, 80,000 lbs. (about double that of the ordinary lathe of the same swing), indicates its massiveness and rigidity. I have no record of its output, but as each rest is carrying two cutting tools it may reasonably be presumed that the time of turning is materially reduced.

Another perhaps equally important change is the adoption of motor drive. This was received at first with some degree of doubt, but it has come to stay, and its value is no longer questioned. While there are instances in which the application of motors has been carried to extremes, their use in connection with the larger and most of the medium size tools has proved eminently satisfactory. The extremes referred to are found where the attachment has been made to very small tools, the cost, size and weight of the motors offsetting the economy in their use. The experience of those who have most carefully investigated the subject has demonstrated that direct connection is only serviceable on the larger machines, and that the smallest should be grouped and operated by short lengths of line shaft with motor attached. It is expected that in time the cost and design of the smaller motors may be modified so as to extend the range of their usefulness, but at present the limit is plainly visible.

The greatest difficulty encountered by the manufacturer is the diversity of opinion among the purchasers regarding the type of motors that should be employed. Between alternating current, series, compound, shunt wound and multiple voltage systems, his lot in life has become a most unhappy one. No standard construction suitable for all can be maintained, consequently specials must be built at increased cost and delay in delivery. If alternating current, variable speed motors can be produced of anything like uniform dimensions for the same power, most of the annoyance now occasioned will disappear. The advantages accruing from this method, under correct conditions, are well understood, the more prominent being speed regulation, absence of belts, free head room for crane service, and economy in operation.

The magnetic clutch on machines with reciprocating movement promises to meet the requirements fully, although as yet it has not reached the perfect stage. Residual magnetism is the troublesome quantity, but there is every prospect of this defect being eliminated. Magnet relief for planer, slotter and shaper aprons has just been introduced, and has accomplished what no former mechanical contrivance could be made to do.

For convenience we may divide all machines into two classes, general and special. The former includes those employed in doing the work on a great variety of pieces, and the latter for some specific duty only, or, at the most, for a very limited number of parts.

Special Tools.

The trend toward the specials is particularly noticeable in railway machinery, the axle lathe, car-wheel borer, cylinder borer, frog and switch planer, the rod borer, the car-wheel lathe, the frame planer, the fame slotter and numerous others.

Sharp competition, making minimum cost with maximum output of product a necessity, created the call for such tools, and their use has fully demonstrated their efficiency. One great advantage they possess lies in the requirement of unskilled labor in their operation. Any man entirely lacking in mechanical experience can soon be taught to manipulate them so skilfully as to obtain the best results.

An objection that has been urged against them is the insufficiency of work of a kind suitable to keep them continually employed, but this is usually not well founded. As a general proposition, any machine costing not over $3,000 (and few of them for railway purposes are as expensive as this) can remain idle at least 50% of the time without loss to the company. Interest on the investment at 6% per annum is $180; wear and tear, at 10% for six months, is $150; labor, at 25 cents per hour for six months, is $375; general expense, at 15 cents per hour, is $225; a total of $930. Estimating the value of the product, exclusive of material, at 65 cents per hour (a very low figure), gives $975, showing a slight balance for the profit side of the ledger. The most tangible economy, however, is in the shortening of the period in which locomotives and cars are out of service.

The ancient practice of boring cylinders in lathes, with boring-heads filled with wooden blocks, days being consumed in the work, has given way to simpler methods in cylinder borers, the main opening and the end facing being accomplished simultaneously, with a saving of time of nearly 50%. The latest double axe lathes have increased the output from 4 to 5 axles per day to 15 or 20. Driving wheels are now finished at the rate of two pair per day, instead of one pair in two days. Car wheels are now bored in from 7 to 10 minutes, two cuts being taken; and steel-tired wheels are turned in car-wheel lathes in two hours per pair.

Frames, in frame slotters, planers and drills, are completed in 20% of the time formerly required; and in arch-bars, tie-bars, side sheets, crown sheets, flue sheets, and a large variety of boiler and car work, eight to ten holes can now be drilled in the time heretofore needed for one, with arch-bar and multiple drills. Power presses, with pressure gauge and safety attachments, turn out four to five times the work the older machines could, and do it so well that trouble from broken and loose wheels is now rarely encountered.

Bending rools shape up boiler shells of the heaviest material, at one pass, at a speed of from 10 to 12 ft. per minute. Hy-

*Abstract of a paper presented at the November meeting of the Western Railway Club, Chicago.

draulic riveters and flangers, punches with spacing tables, shearing and plate planing tools have worked a miracle in boiler work. Three-spindle bolt cutters and seven-spindle tappers have supplanted the single and double-spindle tools, and automatic screw machines now turn out more bolts in an hour than a lathe could in a day.

Tools and appliances more especially adapted for repair work include portable cylinder borers, valve-seat planers, crank-pin turners, flue welders and cleaners, stay-bolt cutters, portable crank-pin presses, and numerous devices of similar character. The work done by them has effected an enormous saving in proportion to their cost.

Air compressors, making the service of pneumatic hoists, chisels, drills, flue expanders, cushion cleaners and paint sprayers possible, are now very generally installed with excellent results, and bulldozers, upsetting machines and steam hammers are indispensable adjuncts of the modern smith shops.

General Tools.

While so much thought was being expended on the special, the general class has not been neglected. Boring, planing, shaping, slotting, turning, drilling and other machines have been virtually redesigned, supplied with automatic stops wherever possible, and quick adjustments, by hand and power, have replaced older and slower movements. The range of feeds and speeds has been enlarged until, with the additional power supplied, the only limit is the durability and strength of the cutter.

Convenience in manipulation and minimizing cost of repairs are points that have obtained more than casual investigation. The reduction of frictional losses, a subject overlooked by the copyist, has been diligently studied by the expert designer with the most gratifying returns for his efforts. Correct shape of gear teeth, momentum of pieces running at high velocities, torsional, longitudinal and transverse strains have each been investigated by careful and extended experiment and the information received used to the betterment of previous designs.

Wood-Working Tools.

Wood-working machinery has kept pace with the iron-working, and this line embraces machines very different from those of even ten years ago. Old patterns have been greatly improved and new ones added. By keeping the automatic feature constantly in mind, mistakes due to carelessness can scarcely occur, the acts of cutting, handling, starting, spacing and aligning being performed almost independently of the operator.

The increased carrying capacity of cars increased the dimensions of the material composing them, and therefore the need of larger and heavier machines for handling the different pieces was imperative. Among the most noteworthy is the four-sided car-still planer and timber dresser, capable of planing the several sides of the largest timber in one operation. The hollow-chisel mortiser has crowded to obscurity the old stroke mortiser, doing the work in one-fifth the time without noise or vibration. Its companion is the tenoning machine, made either vertical or horizontal, with which tenons can be cut on both ends without reversing the timber.

The traversing gainer has developed from the simple hand to the accurate and positive automatic machine, with traveling carriage, adjustable head and stop attachment for correctly gauging the depth of cut. combined gainer and tenorer is now being perfected that promises to still further reduce the cost of this class of work. Boring machines, with three or more spindles, producing holes at any angle, enable one man to do the work of three on any other. Band saws, cross-cut, cut-off and rip-saws have also received their share of attention.

The universal wood worker is not so well known in car shops, but is enlarging its field steadily. For doing a variety of work quickly and perfectly it is unexcelled, Planing, sawing, gaining, tenoning, rabbeting, boring and shaping are all under its scope, and this, with its simplicity, should make it indispensable in repair shops. The molding machine has possibly been more improved than any other. As it is designed for fine work, everything depends on its accuracy. It was evolved from a crude planer, with a single head, and now the second, third, fourth and even fifth head has been added, with corresponding increase in its capacity.

Machinery for Hoisting Material.

While this paper can only touch the surface of the subject, it would be still more superficial if it failed to refer to the marked advance in handling material and completed constructions. Electric overhead, traveling cranes, with auxiliary hoists, have signalled the disappearance of drop-tables, and the era of main strength and awkwardness is at an end. Motor drive for transfer and turntables has solved the problem of locomotive and car manipulation.

We might continue enumerating machines and appliances of similar character, but it seems unnecessary. Those mentioned will show sufficiently the general trend, and the effect of their use is manifest in the enormous increase in business and profits obtained by those roads on which economic problems have been solved.

Obituary.

Charles B. Houston, who was connected with the early development of the iron industry in the eastern part of Pennsylvania, died at the German Hospital, Philadelphia, Pa., on Nov. 28, from injuries received in a railroad accident. He was born near Belfast, Ireland, in Dec., 1832, and came to this country when a child. He was reared on a farm in Lancaster and got his early education at the State Normal School in Millersville, Pa. In 1869 he became freight agent for the Pennsylvania Railroad at Christiana, where he remained ten years. He resigned this position to join his brother, Thomas J. Houston, in the construction of iron works at Greensboro, N. C., for a company of capitalists. After a year and a half he returned North and entered the employ of McCormick & Co., which operated large iron works at Harrisburg, Pa. There he remained until 1874, when he entered into partnership with John Roach and built and operated the Chester Rolling Mills. In 1892 he joined in the coal and coke business in Philadelphia with his son, Howard H. Houston, mayor of Chester, and J. Max Bernard. He was director of the Chester National Bank, the Delaware River Iron Ship Building & Engine Works, of Chester, the Crozer Steel & Iron Co., of Roanoke; the Edith Iron & Coal Mining Co., of Virginia, and was half owner of the Houston Coal & Iron Co., Elkhorn, W. Va.

Central Pipe, Valve & Construction Co.

The Central Pipe & Valve Co., of Allegheny, Pa., has been reorganized under the name of the Central Pipe, Valve & Construction Co., with a capital of $100,000. W. D. Corcoran has been elected president and general manager and Houston Hill, secretary and treasurer. Mr. Corcoran was connected with Howe, Brown & Co., Ltd., for thirteen years and resigned as manager upon the formation of the Crucible Steel Co., of America. Mr. Hill was also connected with this concern at one time but during the past few years has been connected with the Central Pipe & Valve Co., he being one of the organizers of this company. Extensive improvements are to be made to the plant and considerable new machinery will be purchased. The present foundry is to be almost entirely rebuilt. As soon as the lease on the present property expires it is the intention to remove the plant to a larger and more desirable site and an immense pipe bending, pipe fitting and casting plant will be erected. The company does all kinds of steam and hydraulic work having done all the pipe work in the plant of the Colonial Steel Co., Monaca, Pa.

The Standard Pump & Engine Co., Cleveland, has been incorporated with a capital of $10,000 and has rented a building at 51-53 Vermont St., where gas and gasoline engines will be manufactured for both power and pumping. The incorporators are John M. Marty, Jr., Virgil J. Terrell, Geo. B. Marty, B. Sry and Wm. Wisner White.

The By-Product Coke Oven Co., with a capital stock of $400,000, has been incorporated in New Jersey. The incorporators are Mahlon Updike, E. L. Lorscheider and F. M. Thompson, all of whom give their address as No. 419 Market St., Camden, N. J.

MATERIAL AND MACHINERY CONTRACTS FOR THE NAVY.

(Special Correspondence.)

WASHINGTON, Dec. 9.—Proposals for machinery and material will be opened at the Bureau of Supplies and Accounts of the Navy Department this month, as follows:

On Dec. 16 bids for furnishing for the Mare Island Navy Yard, Mare Island, Cal., the following: 500 pounds of bar iron, 4,000 pounds of channel iron, 500 pounds of channel steel, 10,400 pounds of flat bar steel of assorted sizes, one special No. 1 wire-feed screw machine with a capacity ½ inch in diameter, 3 inches in length, through the wire feed 7/8 inches when feeding finger is removed, machine to have swing over bed of 9¼ inches, over cross slide of 4⅛ inches, and to be capable of turning 3 inches in length and to have a large number of extra parts; two 14-inch electric motor-driven screw-cutting engine lathes, each lathe to take between centers 36 inches and to swing over carriage 8⅝ inches; one 10-inch slotting machine with relief tool apron.

On Dec. 23 there will be opened bids for supplying for the Navy Yard, Puget Sound, Wash., 1,800 pounds of solid half-round bead iron and 2,000 pounds of iron channel bars of assorted sizes. On the same date proposals will be received for the installation at the Naval Station at New Orleans, of a complete power plant consisting of three water-tube boilers of 125 horsepower each, two boiler feed pumps, one feed-water heater, one self-supporting steel chimney, one damper regulator, one complete piping system, two generating sets of 50 kilowatts each, one motor generator, one complete switchboard and wiring and two steam-driven air compressors, each of a capacity of 300 cubic feet of air per minute.

Morris & Lewis, who for several years have operated the Rock Island Iron Works, Rock Island, Ill., have purchased the Boughton foundry, near the stock yards in Chicago, which has a daily capacity of 100 tons of castings. The foundry building is 200 by 125 feet, with good switching facilities. It is being overhauled and will be in operation about Dec. 15. A new corporation known as the Western Iron & Steel Co., has been formed and the Chicago plant will be operated under that name.

Dodge & Day, engineers, of New York, have been commissioned by the Heating, Ventilating & Foundry Co., of Pittsburg, to equip the new plant which is being erected for that company at Wheeling, W. Va.

COAL-HOISTING EQUIPMENT FOR POWER HOUSES.

The solution of the problem involved in the handling of coal at a large power house is exemplified in the installation of which several views are given herewith. It consists of a car elevator and transfer car designed by the Wellman-Seaver-Morgan Engineering Co., of Cleveland, and furnished the Cleveland Electric Railway Co. for its Cedar Avenue power house. The work required was the transferring of loaded coal cars from the side track of a standard gauge railroad to the storage bins over the tops of the boilers in the boiler house of the railway company; also the transfer of cars loaded with ashes from beneath the ash hoppers of the boilers to the railroad track. A transfer table is provided, on which one loaded coal car at a time is conveyed from the side track to an elevator which raises it to a track running over the coal storage bins. A dinkey engine electrically driven is employed to haul the loaded car over the side track to the transfer table. The latter is 45 feet long, of the ordinary form of construction and of extra heavy design, in order to handle easily

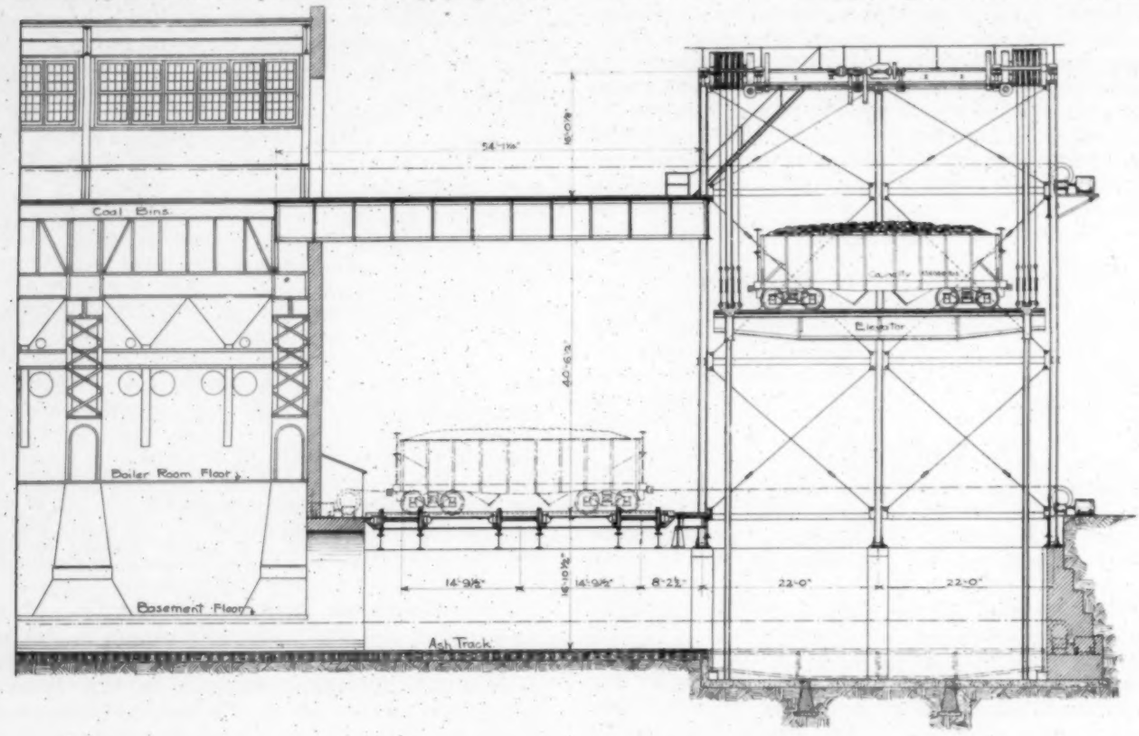


FIG. 1.—SECTIONAL SIDE ELEVATION OF COAL HOISTING PLANT.

the load of a modern steel car weighing with its contents approximately 140,000 pounds. The steel platform of the transfer table rests upon and is carried by 12 single flange standard car wheels. Two pairs of these wheels are geared together and connected to an electric motor by a train of spur gearing. One end of the transfer table is arranged to connect with the platform of the car elevator, the frame work and guides of which extend from the level of the floor of the cellar underneath the boilers to the top of the roof of the boiler house. On top of the framework is located the hoisting gear of the elevator. This gearing consists of four drums geared together to work in unison and connected with an electric motor by a train of steel spur gearing. The gearing is provided with two entirely independent safety devices so arranged that it is impossible for the load to be dropped. One of the devices consists of a set of interlocking worm gearing; the other of efficient electric and mechanical brakes. To each of the winding drums are connected four wire rope lifting cables, the lower ends being attached to adjusting devices and equalizers, so that the load is uniformily distributed over all of the ropes.

By means of another dinkey engine the car is hauled from the elevator and into the boiler house and is stopped at whatever bunker is desired. The pockets of the car are then opened and the coal falls into the bunker. The bunkers at the power house have a total capacity of 2,000 tons of coal.

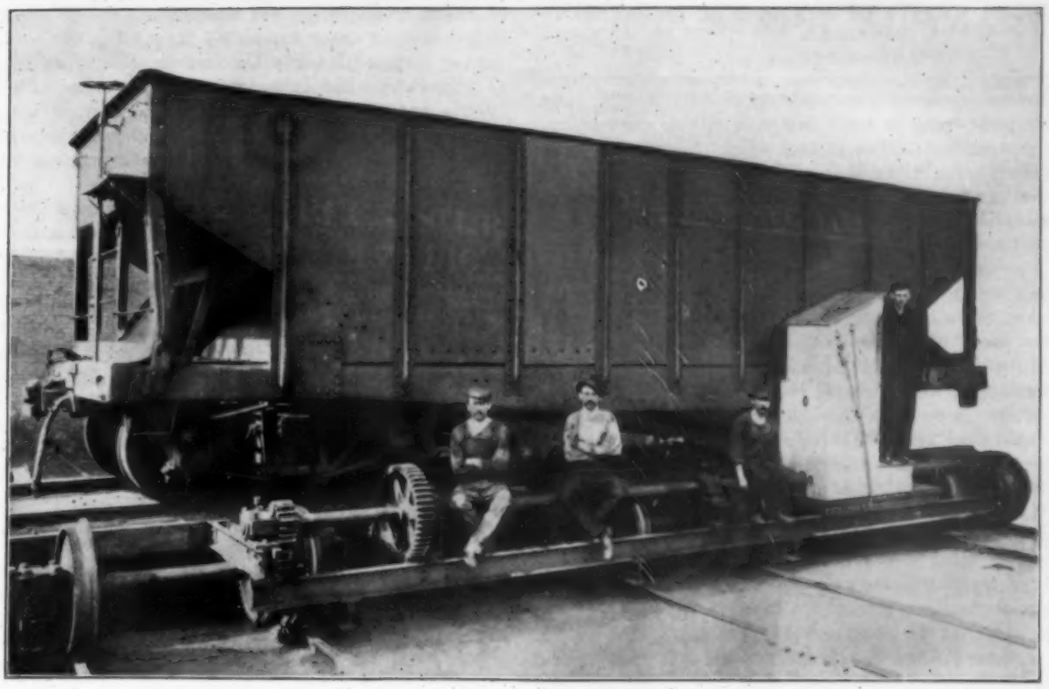


FIG. 2.—CAR ON SHIFTING TABLE.

When it is desired to use one of these emptied cars in the removal of ashes, after it has been returned to the elevator platform and lowered, it is transferred from the elevator platform on to a track running underneath the boilers. It is stopped beneath the chutes into which the ashes fall, the contents of the latter are dropped and the loaded car is hauled to a siding, where its contents are unloaded into wagons to be taken to the dump. Three men are required by the system, one in charge of the electrical operations and two to open the cars and level off the coal at the bunkers, these three doing the work formerly requiring more than a score of men.

The Mayer Fertilizer & Junk Co., of St. Louis, which for 40 years has occupied the yard at 1012 to 1022 North 12th Street, St. Louis, has removed to its new railroad yards corner of Adelaide and Bulwer Aves. The company has installed a complete electric shearing and lighting plant and has erected buildings covering 2½ acres. This concern was formerly well known to the scrap iron trade as the A. B. Mayer Mfg. Co. It has one of the most complete plants in that trade for the rapid and economical handling of scrap iron. It is also a large manufacturer of bone fertilizer.

The Frontier Iron Works, of Buffalo, N. Y., has placed its foundry in operation. Some time ago the abandoned plant of the New York Car Wheel Co. was secured and was fitted up for a small iron foundry. The new company will incorporate shortly.

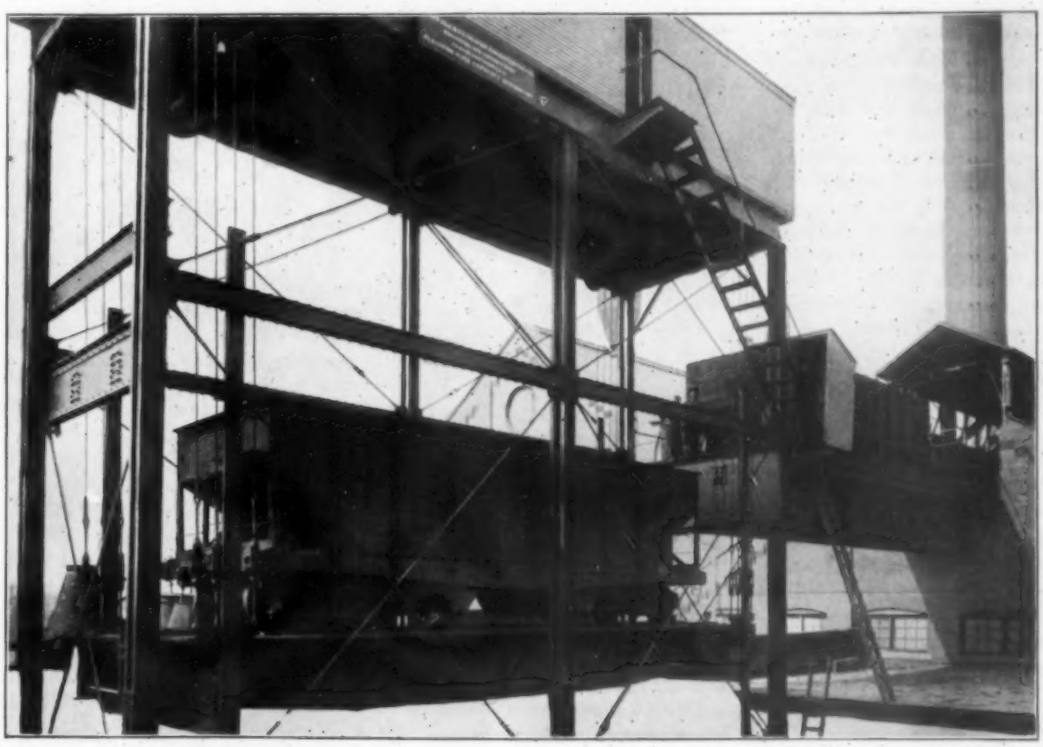


FIG. 3.—CAR ON ELEVATOR OF COAL-HOISTING PLANT.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

[Continued from page 34.]

tables in detail for moving each portion of the work, the most important point being to avoid delays in making connections. Having gotten the schedule in such shape that we can make connections promptly, the next effort of the manufacturer is to shorten the time of each piece over its route as much as possible. This can be done by shortening the time on each element of the route as represented by an instruction card, and by changing the route. Both of these operations in manufacturing are best done by experts, here again bearing out the analogy to a railroad, and new instruction cards and schedules made out. The compensation set for following these instruction cards must be made satisfactory to the workman or the piece will not move promptly. The foreman who sees that the pieces pass through his territory on schedule time should also get additional compensation for efficiency. Thus the whole system produces harmony, the foreman being instructors and helpers rather than drivers, for their interest and that of the men is the same.

"I do not pretend that what I have outlined is all in operation in one place; that would be more than the most sanguine could hope for as the result of less than a year's work, but I can point to nearly everything in operation somewhere; and the best feature of the whole subject is the hearty co-operation of all concerned when they have once grasped the idea and got it started. The foreman of a foundry where this has been started told me that his job was much more pleasant than it had been. The order in which his work was wanted had been fixed and he was not bothered by people who thought they ought to be served first. The foreman of the machine shop in the same plant told me that his running around had been cut in half.

"In other words exact instructions and records in place of judgment and memory will put responsibility where it belongs and give credit where it is due. To sum up the subject, then, the bonus system consists simply in:

1. Having every problem, big or little, investigated by the best experts available.
2. Teaching the results of the expert investigation to those not capable of making it.
3. Rewarding such men as show themselves able and willing to carry out the methods adopted.

"The direct results are:

Increase in quantity of output.
Increase in economy of output.
Increase in efficiency of workmen.

"An indirect result of the keeping the exact records that such a system demands is the moral effect, for in the daily balancing of accounts everything comes to light, and he who prefers darkness finds the conditions unpleasant.

"As some will ask about the amount of clerical work needed, I might as well answer it now. The subject of shop records and shop accounting has until lately been given so little attention that the ordinary methods are very crude for the reason that few shop men are expert bookkeepers and few bookkeepers know the needs of the shop. By the adoption of modern methods all the clerical work I have indicated can usually be done by the time and cost department in addition to their regular work without additional clerks, and sometimes with fewer."

Topical Questions.

The paper by W. Trinks on the "Deflection of Beams by Graphics" was read by title only and then the first in the series of topical questions was taken up. This was the contribution by Prof. F. R. Hutton on "Smoke Consumption." The paper directed attention to the amount of smoke produced by the use of automatic stokers as compared with hand firing. The same make of boilers being used in each case. Mr. Henning told of the Langer system of smoke consumption and its successful employment abroad under rigid rules and equally drastic penalties for violation; and Mr. Bates described the combustion of Illinois coal in St. Louis where the requirements of smokeless combustion were very severe in the instance cited. The coal was coked on the front of the grate and then was forced toward the rear with the hoe, a new installment being placed at the front.

Thursday afternoon was devoted to trips to the different power stations of the Interurban Street Railway Co., the Manhattan Elevated Railway Co. and the New York Edison Co. Transportation had been donated by the street railway companies and the members enjoyed the rarity of a ride in a horse car, a reminiscent pleasure heightened by contrast on this journey to inspect these remarkable monuments to modern mechanical engineering.

The evening was allotted to the reception and conversazione at Sherry's which had all the enjoyable characteristics of previous occasions of the kind.

FRIDAY'S SESSION.

Friday morning saw the members back in the house with smaller numbers in attendance. John T. Wilkin presented a paper on "Rotary Pumps." The corrected copy which appears in this issue has been amended by the author. Mr. Wilkin exhibited models of the cycloidal impeller and casing and outlined the field best covered by this type of pump. Prof. Kingsbury inquired as to the advantages of the cycloidal form over the involute curve. Mr. Wilkin replied that the involute started with a radius of zero and then passed out to a point where there was an abrupt end while the cycloidal curve followed out and back without a change of type. The matter of air chambers was discussed by Mr. McBride who claimed that it was not so material where the air chamber was placed; that it was in the main a question of capacity. Pumps were often so located that the air chamber could not be placed where Mr. Wheeler, who had been mentioned by Mr. Wilkin, would desire to have them. Mr. Wilkin announced his intention of placing before the society at a later date a complete series of tests with large units.

The paper on a "Filing System for Office Use," by H. M. Lane dealt with the experience of that gentleman in maintaining such a method at the correspondence school at Scranton, Pa. Mr. Fowler's method was quite similar but he carefully underscored everything of any value to him in every catalogue and these items were thoroughly indexed by cards. A suggestion offered by Mr. Partridge was on the line now followed by public libraries and permitted the use of the card catalogue by any one, but restricted the replacing of the cards after use to one person only. The difficulty of properly indexing subjects under such headings that they could be promptly found was capable of but the treatment advised by Mr. Supplee and others: a large number of cross reference cards; not stinting these in any way, generosity being the only resource.

A. F. Nagle was not present but his paper on the "Analysis of Water Power" was commented on at length by George I. Rockwood who could not agree with the author. Mr. Rockwood exhibited the photographs of an integrating machine brought out at the Worcester Institute of Technology and applicable to the record and rating of water powers.

"Centrifugal Machines" was presented with a number of exhibition machines by B. Viola. It is worthy of note in view of the discussion on the metric system that the second page of the paper has a reproduction of a drawing figured in the regular machine shop fashion common in this country and on the third page appears another drawing just as carefully dimensioned in the metric system. The author was unfortunate in a part at least of his exhibition, in not getting satisfactory results from the machines, but this had no depressing effect upon the good humored exhibitor and he dryly intimated that his failure to separate any cream from the sample of milk he employed may have been due to the fact that he did not get at the liquid first. Mr. Kent pointed out that the formulas given in the paper were worthless unless some values were assigned to the constants and suggested the incorporation of these.

Prof. Kingsbury read a paper on "Oil Testing Machines and Results." It received the cordial appreciation of Prof. R. H. Thurston and others. Mr. Kent suggested that it might be improved by a change in the engravings which would better show the construction of the working part of the testing machine. Prof. Kingsbury said the torque was measured in his machine by the deflection of a fine wire which served as the connection to the vertical spindle rather than as the deflection of a pendulum swung from a bearing on a horizontal shaft. This was the main difference between his machine and that of Prof. Thurston.

The topical query dealing with the elasticity of rubber was then discussed by Messrs. Henning, Hale, Kingsbury and others. Attention was directed to the fact that when rubber is subject to pressure on all sides with an absence of voids in the material, rubber in such a constrained position is less compressible than water. H. H. Supplee described a tube expander for boiler work in which a rubber piston was compressed along the axis of the tube and the pressure forced out the walls of the tube around the hole in the plate.

The description of an oil burner in another of the topical questions brought out the statement that the increase in cost of insurance often brings the cost of burning oil up to that of coal. The use of oil was suggested as an aid to consumption of smoke from coal fires. It is possible to have a mixing chamber in back of the boiler setting to ensure the smokeless combustion of the coal. Mr. Wilkin said the Gould Coupler Co., of Depew, N. Y., were running annealing furnaces by a combination method of measuring the mixture of oil and air. The discussion developed a statement that the Standard Oil Co. did not use oil but coal under the stills, on account of the economy. The use of oil in connection with coal had been tried on the German torpedo boats. Mr. Fowler told of the attempts of Mr. Holden of the Northern Railway Co., of England, to introduce oil and Prof. Kingsbury followed with an account of the labor of Mr. Dudley on the Pennsylvania Railroad some 15 years ago. Mr. Kent said it was not so much a question of burner but handling the device with judgment. The burners on the market are largely copies of Urquhart's patent long ago employed in Russia.

The separator was discussed in another topical query. It was stated that the pores in the plates filled up with oil after an extended use and required a thorough cleansing with potash and water to restore the original efficiency. Cleaning the plate is necessary and not so well known as it should be.

Oberlin Smith discussed the oil tempering of steel. The difference between oil and water is all a matter of body, the real question being the quickness with which the heat leaves the materials. Mercury is a good conductor of heat, and there being more body in brine this also conducts heat rapidly. Oil is a sluggish conductor on the contrary. Lower carbon also requires a bigger stream of water.

Mr. Kent presented a resolution that the council be instructed to obtain the opinion of the members on the two parts of the new metric law and that the discussion already had be also sent to the membership. This was adopted.

The meeting then adjourned to reassemble in Saratoga in the mid-year meeting of 1903.

Swedish Ore for Nova Scotia.

A cargo of 5,200 tons, the first Swedish ore ever shipped to America, arrived at Sydney, Cape Breton, Nov. 29, for the Dominion Iron & Steel Co. A fleet of large steamers will carry from Swedish and Norwegian ports iron ore from Northern Sweden, and will have return cargoes of coal from the Dominion Coal Co.'s mines. Sweden expects that this trade will enable her to operate her iron ore mines during the winter and summer months, and the Dominion Iron & Steel Co. believes it will contribute to the manufacture at these works of the best quality of iron and steel.

Four steamers are now on their way to Sydney with ore, and will carry over 30,000 tons of coal from Sydney to Europe.

Several plants have recently been purchased by the American Screw Co., of Providence, including the Massachusetts Screw Co., of Holyoke, mentioned in these columns last week. The Providence concern is now said to be trying to obtain other small plants in New England. These purchases have been regarded by many as forecasting the organization of a consolidation of screw manufacturers. It is well known that owing to keen competition there has been little profit in the screw business and there is now a disposition to establish it on a more profitable basis. If the purchasing of the smaller concerns by the larger continues, an effort will probably be made to consolidate the latter or at least to unite them on a working agreement, but there is no prospect that this can be done in the near future.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

Fires and Accidents:—

The shop and foundry of the Montmaguy Mfg. Co., Montmaguy, Quebec, were destroyed by fire Dec. 1.

The plant of the Greensburg Foundry & Machinery Co., Greensburg, Pa., was destroyed by fire Dec. 2. Loss $6,000; insurance, $3,400.

Fire on the night of Dec. 4 partially destroyed the plants of Bardons & Oliver, machinists, and Likly & Rockett, trunk manufacturers, Cleveland. Falling walls killed one fireman, injured others and damaged the office of the National Iron & Wire Co. The total loss was about $150,000.

Fire destroyed the machine and supply houses of the Pocahontas Colleries Co., at Pocahontas, Va., Dec. 2. Two steel tanks used for the storage of kerosene oil exploded. Estimated damage, $25,000.

The tilting of a ladel containing molten iron at the plant of the Sharon Steel Co., Sharon, Pa., caused the death of two workmen and the serious injury of three others.

New Buyers in the Market and Some of their Wants:—

The Withington Perfection Spring Lock Fence Co., Adrian, Mich., has been incorporated with $100,000 capital for the purpose of operating a plant for the manufacture of wire fencing. A small plant manufacturing this style of fence is now in operation at Adrian, but plans have been prepared for a much larger plant which will be erected shortly after the first of the year. Officers have been elected as follows: S. S. Withington, president; W. W. Cook, vice-president; W. H. Shearson, secretary, and N. B. Hayes, treasurer.

The Warrior Mfg. Co., with a capital of $10,000, has been incorporated at Birmingham, Ala., to manufacture machinery. J. D. and B. F. Moore are the incorporators.

At a meeting of the stockholders of the LaBelle Iron Works, of Steubenville, O., to be held at Wheeling, W. Va., on December 16, the present capitalization of $5,000,000 is to be increased to $7,500,000. The increased capital is to cover recent purchases of coal land and it is also the intention to buy considerable ore property. The company's furnace at Wheeling will be blown in about February 1.

The British Westinghouse Co., of Manchester, Eng., will increase its capitalization by issuing additional preferred stock to the amount of $1,000,000. At present the company's outstanding obligations amount to $5,000,000 of preferred stock and $3,750,000 common. Orders received since August 1 exceed in amount $4,125,000, against a total of $4,660,000 for the year ending July 31. Lieutenant Colonel Montagu Cradock has been appointed a director of the company to succeed Lemuel Bannister.

The George W. Jackson Structural Iron & Bridge Co., of Chicago, Ill., has been incorporated with $100,000 capital to engage in the fitting of structural material and the erection of buildings and bridges. George W. Jackson, John A. Corbett and John T. Fanning are the incorporators.

The Washington Pipe & Foundry Co., of Spokane, Wash., has been incorporated with $100,000 capital for the purpose of engaging in the manufacture of cast iron pipe. L. H. Long, H. Orchard and W. D. Russell are the incorporators.

The Safety Switch Rail Lock Mfg. Co., of St. Louis, Mo., has been incorporated with $10,000 capital to manufacture and deal in railway supplies. Jay Noble, J. J. Holscher, M. R. Orthwein and A. O. Leggatt are the incorporators.

The Algoma Iron Mining Co., of Duluth, Minn., has been incorporated with $50,000 capital for the purpose of developing ore properties. D. E. Woodbridge, J. L. Washburn and D. E. Bailey are the incorporators.

The Moselem Mining Co., of Allentown, Pa., has been incorporated with $40,000 capital for the purpose of operating iron ore and limestone properties at Moselem. H. K. Hartzell, A. C. Godshall, H. H. Godshall, J. R. Weisner and J. K. Spang are the incorporators.

The Western Coal & Iron Co., of Tacoma, Wash., has been incorporated with $750,000 capital. Nelson Bennett, F. W.

Gaston, L. Pratt, B. Olson, William Reynolds, S. A. Hantman and I. H. Case are the incorporators.

The Maryland Sheet Steel Co., Cumberland, Md., has increased its capital from $50,000 to $100,000.

The Ottawa Steel Casting Co., of Ottawa, Ont., has been incorporated with $250,000 capital. G. G. Roe, J. E. Askwith, J. H. Gervan, G. B. Norton, D. C. MacLaren, J. G. MacLaren, and A. J. McGibbon are the incorporators.

The Restigouche Foundry & Supply Co., of Campbellton, N. B., has been incorporated with $100,000 capital. W. J. Duncan, A. McLennan, A. E. Alexander, K. Shives, W. A. Mott and W. S. Montgomery are the incorporators.

The Warren Brass Co., of Warren, O., has been incorporated with $30,000 capital to manufacture brass goods. C. L. Wood, E. King, W. J. Jencks, W. H. Cottle and H. W. Risk are the incorporators.

The Seneca Chain Co., Kent, O., has increased its capitalization from $25,000 to $50,000.

The Roland Pattern Co., Cleveland, has been reorganized, George Awlmendinger, formerly with the American Pattern Co., having become a member of the new company, which will soon be incorporated as the United States Pattern Co. The location has been changed from Columbus St. to 35 Michigan St.

The Economy Gas Machine Co., Rochester, N. Y., desires to correspond with companies that make everything which it uses, such as pipe, brass, black and galvanized gas pipe, leather pump valves, gas meters, pressed steel tanks, steel barrels, light brass castings, plain and galvanized castings. The company desires to decide whether it will be cheaper to buy raw material or to have it made up under contract. The company was incorporated last month with a capital of $12,000.

The Jacksonville Machine & Boiler Co., Jacksonville, Ill., has been incorporated with a capital of $6,000. General repair work will be done.

The Columbus Screw Machine Co., Columbus, O. has been incorporated with a capital of $15,000 by J. B. Foster, Allan Cole, Henry Bechtold, L. V. Kuhn, T. J. Ferrell, John B. Flaeohn and Wm. Tomlinson.

The Libby Engineering & Construction Co., Toledo, O., recently incorporated, has erected a temporary shop and has commenced to build Seiver and French machines. The company is progressing along conservative lines and has excellent prospects.

The capital of the Meadville Malleable Iron Co., Meadville, Pa., has been increased from $100,000 to $150,000. The capacity of the plant will be doubled.

The Buffalo Foundry Co., Buffalo, N. Y., has increased its capital from $10,000 to $200,000.

The Antigo Hoop & Stove Co., Antigo, Wisconsin, has been incorporated with a capital of $20,000.

A steel castings company is being organized at Chester, Pa., with a capital of $250,000.

The Chicago Heights Foundry Co., Chicago, has been incorporated with a capital of $5,000.

Baldwin Mfg. Co., Bank, Md., will buy boiler and engine.

Neches Iron Works, Beaumont, Tex., need electric traveling crane and multiple drill, three, four or five-spindle adjustable table, second-hand.

Bamberg Iron Works, Bamberg, S. C., will be in the market for 10 or 12 feet by 20 or 24-inch swing lathe, second-hand, also 24-inch drill press, 24-inch planer and shaper, stocks, dies and small bolt and pipe machine.

Southwestern Brick & Tile Mfg. Co., 714 Austerlitz Building, New Orleans, La., wants bids on large centrifugal pumps.

The Colorado Foundry Co., Colorado Springs, Col., has been incorporated by F. D. Wallaker, Denver; O. P. Sells, Pueblo; and A. T. McKeever, of New York. The capital stock is $100,000.

The East St. Louis Locomotive & Machine Shop Co., East St. Louis, has been incorporated with a capital of $25,000, to manufacture and repair locomotives. The incorporators are M. M. Stephens, W. S. Warman and H. L. Browning.

The Rising Sun Mfg. Co. has been incorporated at Chattanooga, Tenn., by A. D. Simpson, S. Doyle, J. E. White, A. A. Clardy and James Selcer (all negroes), to manufacture stoves, holloware, iron castings and moldings of all kinds. Capital stock is $5,000.

The Illinois Car Co., of Chicago, has been incorporated with a capital of $50,000 to acquire and operate the repair shops at Urbana, O., of the Illinois Car & Equipment Co.

Thomas Worthington, J. L. Dellou and A. V. Vigo have incorporated the Worthington Ore Co., at Birmingham, Ala., to develop iron mines. Capital stock is $12,000.

J. D. Moore and B. F. Moore have incorporated the Warrior Mfg. Co. with capital stock of $ 00,000, at Birmingham, Ala., to manufacture machinery.

The Thomas Coal & Land Co., Tracy City, Tenn, mentioned several weeks ago, has been incorporated as the Thomas Coal & Iron Co., with capital stock of $300,000, and will develop the 60,000 acres of coal and timber lands that were purchased recently. Arrangements will be made for opening coal mines erecting coke ovens, and an iron furnace, it is reported, will be erected eventually. W. H. Thomas, of Columbus, Ohio, is president, and E. M. Jones is resident manager at Tracy City.

New Construction:

The contract has been let for the erection of the pattern building for the new plant of the Interstate Foundry Co., Cleveland. The building will be two stories, 40x60 feet, fireproof construction. Kaltenbach & Griess drafted the plans.

The Langenau Mfg. Co., Cleveland, manufacturer of hardware, will erect an addition at a cost of $5,000.

The Seattle Iron Works, Seattle, Wash., has decided to make extensive improvements to its plant. A new machine shop will be built 70x240 feet. It will be commanded by a 25-ton traveling crane with a forty-foot span. An addition to the foundry 60x60 feet will also be erected.

The Standard Steel Car Co., Butler, Pa., will increase the size of its plant to increase the daily output from 60 cars to 80.

Hugo Bilgram will erect a machine shop at Philadelphia, Pa., whose dimensions will be 119x100 feet. The cost of the building and machinery will be about $50,000.

The American Axe & Tool Co. will erect a bluing shop at its plant, East Douglas, Mass.

The Hart Grain Weigher Co., Peoria, Ill., will erect a foundry.

The Laidlaw-Gunn-Gordon Co., will erect a large pattern shop at Hamilton, O.

The Niagara Falls Machine & Foundry Co., Niagara Falls, N. Y., will double the capacity of its plant by the erection of several large additions to its foundry and machine shop.

The Enterprise Foundry & Equipment Co., Harvey, Ill., will erect a pattern shop 24x40 feet.

The Minneapolis Threshing Machine Co. recently purchased about 35 acres of land adjoining its plant, on which it is erecting some very large buildings. The plant, with the additions, when completed, will cover 75 acres of ground. A new boiler shop is nearing completion and will be equipped with traveling cranes, hydraulic riveters and all of the latest tools and appliances for the manufacture of boilers. The building is 120x265 feet, of solid brick and steel construction. Another building, 120x200 feet, for the erection of engines, is under way, and will be completed February 1. It is of solid brick and steel construction and is equipped with traveling cranes and the latest improved electrical machinery for the speedy handling of engines. An addition, 100x150 feet of solid brick and steel construction, is being made to the foundry, also a new cupola of 20 tons capacity per hour. The foundry will be equipped with the latest improvements in cranes and air hoists. The capacity of the machine shop has been doubled this season, by the erection of additional buildings. Altogether the improvements being made by the company will involve an expenditure exceeeding $250,000, and when completed it will have the largest threshing machine works west of the Mississippi river. The company gives employment to 800 men. Its annual output is 700 engines, 1,000 separators, 1,000 self feeders, weighers, horse powers, and all the tools and appliances used by threshermen. After the completion of the new boiler shops, the company will enter into the construction of all sizes of stationary boilers

and engines on a more extensive scale than heretofore. The growth of the company's business for the past few years, has been very rapid. The business for 1902 will exceed $3,000,000. Mr. F. E. Kenaston is president and treasurer; Mr. H. C. Akeley, vice president; Mrs. W. H. Ritchie, secretary and assistant treasurer; and Mr. Paul Swenson, superintendent. The plant is at West Minneapolis, Hopkins P. O., Minn.

The Page-Hersey Iron & Tube Co., Ltd., Gwelph, Ont., is erecting an iron building 62x226 feet, a steel building 400x70 feet and various smaller buildings in which it will work machinery for making wrought iron pipe, all sizes, ⅛-inch to 12 inches. The buildings will be thoroughly modern in every respect. The company is financed by American and Canadian capital to the extent of half a million dollars. The president of the company is Mr. Randolph Hersey, of Montreal; vice president, Mr. W. W. Near, of Montreal; secretary, H. Westoby, of Guelph; the board of dirctors, Messrs. S. T. Page, George H. Page, W. W. Near, R. Hersey, H. Westoby, D. Muhlfelder, and D. H. Friedman. The plant will be ready in part about May of next year.

Kane & Roach, manufacturers of carriage and wagon machinery and special machinery, Syracuse, N. Y., will soon begin the erection of an addition to their present plant. The new building will be about 60x80 feet and will be for heavy work for rolling mills. Some of the machines will weigh over 40 tons. The firm expects to equip the addition with a traveling crane of at least 20 tons capacity and to put in other heavy machinery, all of which will be built by the firm. Kane & Roach have been in business for 15 years and have had an important influence in educating blacksmiths and wheelrights to the use of up-to-date tools. Fifteen years ago, cheap hand tools, costing from $10 to $30 were in use, and it was difficult to sell anything that cost over $25, but now shops and factories generally are equipped with the latest machines, both in hand and power, and it is easier to sell a machine at $150 or $200 today than it was to sell a $25 machine 15 years ago. Four or five years ago, Kane & Roach began experimenting with straightening machines for rolling mills, starting in with a 5-roll machine and then experimenting with a 7-roll machine. They worked until now they are building the very latest style type of 8 and 12-roll machines. They did not try to push the machines on the market until tests were made and improvements suggested by practical experience were introduced. They now are placing on the market a complete and up-to-date line of straightening machines.

The Deming Co., of Salem, O., is erecting a new building 226x86 feet for its power pump department, which for a long time has been cramped for room. A traveling crane in the main portion of the building will command the entire length of the shop. It is expected that the new plant will be ready for operations in the spring of 1903. The manufacture of power pumps is a rapidly developing department of this company's business.

The Litchfield Mfg. Co., of Webster City, Iowa, which manufactures the "Grain King" sweep grinders and extension end gates, expects to rebuild and largely increase its plant, with a possible change of location. The increasing demand for the company's present lines and the necessity for more room for additional lines call for extensions.

The Allis-Chalmers Co. contemplates making improvements to the Gates Works in Chicago, to the extent of about $400,000. These improvements will include a new foundry, machine shop and store house capacity.

The Collis Pattern Works, Dubuque, Iowa, contemplates building an addition to meet the demands of growing business.

The Wilson Stove Mfg. Co., St. Louis, Mo., will erect a new building, having electric fixtures, electric elevator, motor, dynamo, engine, etc., to cost about $75,000. J. C. Rankin, 715 Locust St., architect.

Bids are being received for the construction of a $600,000 plant to be built at Coplay, Pa., for the Coplay Mfg. Co., J. T. Brady, 1123 Broadway, New York, president. It will consist of two-story machine shop, 40x172; drying house, 270x46; kiln, 240x140; clinker mill, 100x100; stock house, 100x260; crusher mill, 54x54; engine and boiler house, an electric and steam power plant of 3,500 horse power, using water-tube boilers and cross-compound condensing engines. Amos W. Barnes, 901 Walnut St., Philadelphia, Pa., engineer.

The construction of the new blast furnace and steel plant of the Deering Harvester Co., at South Chicago, is progressing at a rate which indicates that it will be finished by May 1. Over 1,000 persons are now engaged on construction work. The foundations of the larger buildings have already been completed, and work is in progress on the blast furnace. The plant will include Bessemer steel works, foundries, machine shops, etc.

Bids will be received until Jan. 1, for the construction of a $40,000 brick machine shop, 56x360, for the Ohio Brass Co., Mansfield, O., Vernon Redding, Mansfield, architect.

The A. Y. McDonald & Morrison Mfg. Co., Dubuque, Iowa, is doing a large and rapidly increasing business. The plant covers five acres on a site of ten acres and employs 325 men. The company is now excavating for a brick addition, 101x266 feet, three stories, which will be used as a machine shop and for storage. The original plant was erected in 1895 and increased to present size in 1895. The company manufactures pumps, using only iron patterns.

The Sheffield Car Co., Three Rivers, Mich., has had plans prepared for a foundry of steel and brick, 90x250 feet, fire proof.

C. A. Lawton & Co., Depere, Wis., recently incorporated as the C. A. Lawton Co., contemplates making extensive additions to the present plant. Particulars are not vet announced.

The Lake Shore Railroad has nearly completed plans for the enlargement of the shops of that railroad at Elkhart, Ind. The size will be nearly doubled. Work on the new buildings will be begun next spring.

The Pittsburg District:—

At a meeting of the board of directors of the Pittsburg Shovel Co., held in the Frick Bldg. last week, it was decided to prepare its plant at Leechburg, Pa., for operation immediately. It is expected that operations can be commenced within the next four weeks. Inquiries are solicited from the trade for their different brands of shovels known as "Pittsburg," "Leechburg," "Armstrong" and "Kiski." When operating full the plant has a capacity of 200 dozen shovels per day.

The Pittsburg Steamship Co., formerly owned by the Carnegie Steel Co. and now the lake operating company of the United States Steel Corporation, has issued notice that it will redeem after Jan. 1, at the Union Trust Co., Pittsburg, $187,000 of its first mortgage bonds bearing 5 percent interest. The original bond issue authorized was $3,000,000, of which $2,700,000 was issued.

The Sligo rolling mills on the South Side have closed down and the machinery is to be removed to Connellsville, Pa., shortly, where the Sligo Iron & Steel Co. has been organized to operate a puddling furnace and several merchant mills.

The Eureka Mfg. Co., of Beaver Falls, Pa., whose organization was noted in these columns recently, will have $50,000 capital and the directors have elected H. W. Bishop, formerly connected with the National Tube Co., president, and T. M. Boggs, formerly connected with the Graham Foundry & Machine Co., at Monongahela City, Pa., as manager. Contracts for the plant will be awarded shortly.

The Pittsburg Railways Co. will erect an addition to its machine shop on Homewood Avenue to cost $10,000.

The management of the Rankin plant of the American Steel & Wire Co. has installed a hospital, a separate building having been erected for this purpose. It contains two rooms, one for operating purposes, and the other to be used as a ward contains a number of cots.

The Clairton Steel Co., Clairton, Pa., placed its eighth open-hearth furnace in operation last week. Four more furnaces are under construction and will be placed in operation shortly.

During November 1,500 tons of finished castings were made at the plant of the Pennsylvania Malleable Co., McKees Rocks, Pa. This output exceeds all former records. The Central Car

Wheel Co., the new subsidiary interest of the Pennsylvania Malleable Co., will have its new plant ready for operation about the middle of January.

The Crescent Electric & Mfg. Co. will apply for a Pennsylvania charter on December 30, for the purpose of engaging in the manufacture of electrical machinery and supplies. C. K. Hill, John D. McNeill and W. F. Mitchell are the incorporators. Mr. Hill is connected with the electrical supply house of C. K. Hill & Co.

The McClintic-Marshall Construction Co. has been awarded the contract for the erection of the large machine shop for the P. & L. E. railroad at McKees Rocks, Pa. This shop is to be 560 feet long and 170 feet wide.

General Industrial Notes:—

The new plant of the Eames Pulley Co., Three Rivers, Mich., was formerly opened last week with a reception and ball to the citizens of the place. The plant is now in full operation.

The Victoria Furnace, at Goshen, Va., was blown in last week after an extended period of idleness.

A prospectus of the recently incorporated Colorado Steel Casting Co., which will erect a steel foundry at Colorado City, Colo., has been issued. It states that the demand for steel castings on the part of the railroads in the West is very heavy, and as they are now principally purchased from eastern manufacturers, a western plant of this kind will be well patronized. It is intended to issue bonds to the extent of $300,000 bearing 5 percent interest. They will be sold at 95 and the money derived in this way is to pay for the site, water rights and the erection of a portion of the plant.

A six-year agreement has been entered into between the International Pneumatic Tool Co., of Chicago, and the Bergmann Electrical Works, of Berlin, Germany, whereby the latter concern will manufacture pneumatic tools for German consumption exclusively for this term of years.

The new skelp mill of the Wheeling Steel & Iron Co., Wheeling, W. Va., has been placed in operation. Heretofore the muck iron was made at the company's Benwood shops and shipped to the Belmont mill at Wheeling, but with the installation of the skelp mill at Benwood the muck will be finished before leaving the mill.

The Western Metal & Supply Co., of San Diego, Cal., has been incorporated with $500,000 capital for the purpose of taking over the hardware and iron and steel jobbing business of McKenzie, Flint & Winsby. The incorporators are: B. W. McKenzie, E. Winsby, G. M. McKenzie, W. H. Beckett, and W. H. Airhart. J. A. Flint, one of the partners in the old company, has sold out his interest and will no longer be connected with this concern. Of the stock issued $400,000 is common and the remainder preferred six percent.

The Shinnick, Woodside & Gibbons Mfg. Co., Zanesville, has been succeeded by the Union Foundry Stove Co. which will manufacture a full line of stoves, ranges, firefronts, grates and other castings.

The Davis Gasoline Engine Co., of Waterloo, Ia., will increase its capital stock from $40,000 to $150,000. It is expected that the Waterloo Gasoline Engine Works will be taken over, as well as an Eastern company now engaged in manufacturing gasoline automobiles.

The Twin City Fence & Wire Works, St. Paul, Minn., enjoyed a very rapid increase of business during the year. A foundry 80x120 feet has been added to the plant. Two important contracts have just been made; one with the Great Northern Railroad for the skylight guards for its new shops in St. Paul, and the structural iron and wire work for the school building for feeble minded at Fairbault, Minn.

The Superior Iron Works, West Superior, Wis., is doing a large jobbing business and is building chair factory machinery; also car haulage engines for cable traction, used for shifting cars on coal docks and elsewhere, and special engines and appliances for dredges.

At Canal Dover, O., the American Sheet Steel Co. has opened a reading and club room for its employes.

The Buffalo Forge Co., Buffalo, N. Y., has purchased the stock of the George L. Squier Mfg. Co., Buffalo, which had done a large business in making machinery for use on sugar, coffee and rice plantations, but was forced into a receivership some time ago.

Rotary Pumps.*

BY JOHN T. WILKIN, CONNERSVILLE, IND.

The writer has been searching diligently for the past sixteen years for information about rotary pumps, in order to have the benefit of the experience of others. The greatest amount of information was found in the United States Patent Office Records, and in Prof. Reuleaux's "Kinematics of Machinery," translated and edited by A. B. W. Kennedy, C. E., and published in 1876 by MacMillan & Co., London—a book which has been out of print for some time and is very difficult to obtain. In this work Prof. Reuleaux cites records of the use of this pump as early as 1630, the pumps described having two impellers, each of which had four lobes or teeth; and he shows and discusses many forms of rotary positive machines, some of which were intended for steam engines, some for pumps, and others for blowers. This book contains the most comprehensive history and discussion of rotary machines that the writer has been able to obtain.

The development and commercial use of rotary pumps kept pace with the other types until about thirty or forty years ago, when they became quite unpopular, largely due to the fact that they were misapplied, and because the manufacturers undertook to produce them too cheaply, in order to compete with centrifugal pumps, making the contact surfaces of the impellers unfinished castings. The misapplication was in using small capacity machines for high pressures, resulting in a large percent of leakage and developing weakness of construction.

After a careful study and analysis of the different forms shown in the above-mentioned records, and also those which were on the market at that time, the writer decided, about ten years ago, that a rotary pump having two similar impellers, the contours of which were formed by complete epi- and hypo-cycloids, would make a machine which would give excellent results if properly constructed and applied. Fig. 1 shows a cross section of such a pump, which is designated as a two-lobe cycloidal pump, and it is this form which will be principally discussed in this paper.

The writer has proceeded with the belief that a rotary pump is a good device for moving large volumes of fluids at low or moderate pressures, and has avoided using them on high pressure work. This form was selected for the following reasons, viz.;

The outlines of the impellers are mathematically correct, hence the clearance can be made uniform.

The shape admits of a strong casting in a single piece, thus avoiding internal fastenings or joints.

The impellers revolve freely in their cylinders, hence there is no internal friction, packing, nor necessity for lubrication.

The minor axis of the impeller is large enough to permit the use of a shaft of ample diameter, leaving sufficient metal for a good hub, and at the same time giving a relatively high capacity to a machine having a given distance between the shaft centres.

There is no sudden change of work on these impellers nor in the pump as a whole.

There is no tendency to form enclosed pockets between the impellers in which the fluid would be compressed, causing unnecessary work.

It is a remarkable fact that all of the principal rotary pumps on the market at that time were so arranged that there were two or more points of contact between the impellers in certain portions of the revolution, thus forming compression spaces, the same as in the case of a pair of gears used as a pump. This reduction of volumes when the pump is used for liquids is very destructive in its effect, and was recognized by certain designers, who provided grooves in the end plates connecting these spaces with the suction side of the pump, thus relieving to some extent the shock. The displacement per revolution of a

*Read at the New York meeting (Dec. 1902) of the American Society of Mechanical Engineers. Mr. Wilkin has made several corrections for *The Iron Trade Review* from the original printed copy.

two-lobe cycloidal pump is exactly the volume of the cylinder in which the impeller revolves, in other words, the area of a two-lobe cycloidal impeller is one-half the the area of the circumscribed circle. This fact makes it possible for this form to be used as a meter, the displacement of which can be very accurately determined.

The discharge from the pump is continuous but not uniform. One of the errors which has been committed in connection with rotary pumps is that their manufacturers have claimed the discharge to be uniform. Figs. 2 and 3 show diagrams of the path of contact between the two impellers, and the variation of work on each one, also the

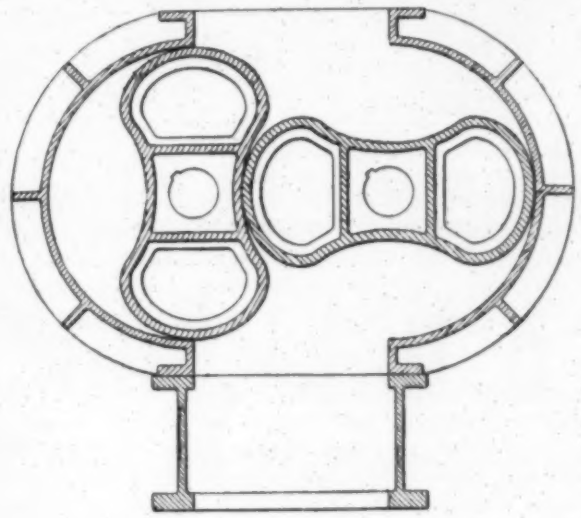


FIG. 1.

variation of the combined work of both. The base line in Fig. 3 is a development of the pitch circle, the radius of which in this case is 2 inches. If the length of the impellers be assumed as unity, the capacity of the pump per revolution is represented by the area enclosed between the base line and the line 2¼ inches above. The dotted curved line in Fig. 3 represents the variation of work of the impeller shown in dotted lines in Fig. 2, while the lower full-curved line in Fig. 3 represents the work of the opposite impeller. The upper curve represents the combined work of both impellers. The distance between the ordinates represents the travel at the pitch line, also the travel of the point of contact in the circumference of the small generating circles. This diagram was made to determine the amount of water which must be absorbed and given off by the air chambers when the pump is used on liquids and the areas between the upper curved line and the line of mean discharge enable us to determine this quantity. It will be noticed that the point of maximum discharge is ten-ninths and the point of minimum discharge is eight-ninths of the mean discharge. The work on each impeller varies from zero to a maximum shown 2 inches above the base line. The minimum work of the pump occurs when the impellers are at right angles to each other, as in this position one impeller is balanced and the opposite one is at its point of maximum work. The position of maximum combined work of the two impellers is when their major axes are parallel to each other and at angles of forty-five degrees to the line of centres.

Assuming one of the shafts to be the driver, the work transmitted by the gears varies with the work of the driven impeller. The maximum gear transmission, therefore, is eight-ninths of the mean work of the pump. The area which each impeller presents to the working pressure is variable, as is also the direction of the resultant pressure, the maximum area of the impeller being exposed to the full difference of pressure, under which the machine is working when the major axis of the impeller is parallel to the line of shaft centres. The points of contact with the cylinder and with the other impeller are on the centre line at this point, and the impeller is in a balanced position doing no effective work, so that in this position the total load due to the pressure, plus the weight of the moving parts, is downward or at right angles to the line of centres. As the impeller leaves this position the direction of pressure and the exposed area vary until the impeller reaches a position at right angles to the line of centres, where it has its maximum unbalanced area exposed, and also where it undergoes a change in direction of pressure, due to the passing from suction to the discharge, of the inclosed volume of fluid between it and the cylinder.

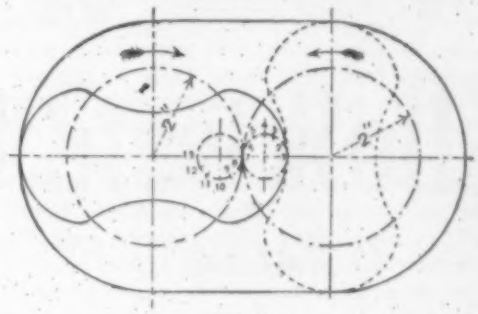


FIG. 2.

In designing rotary pumps one of the principal problems to be solved is the proper provision for supporting the impellers. They are supported by their shafts resting in journal bearings separated from the cylinders by stuffing boxes; hence, the problem is a modification of the beam supported at the ends and carrying a load varying in intensity and direction, the load being distributed over a portion of its length. This problem can hardly be solved by any other method than experience, but when properly solved the rotary pump has proven itself to be an excellent device for moving large volumes of fluids against moderate pressures. The designer of rotary pumps is not compelled to consider a multiplicity of valves, ports, etc., such as is met with in the design of reciprocating machinery, nor does he have the problem of velocities, centrifugal

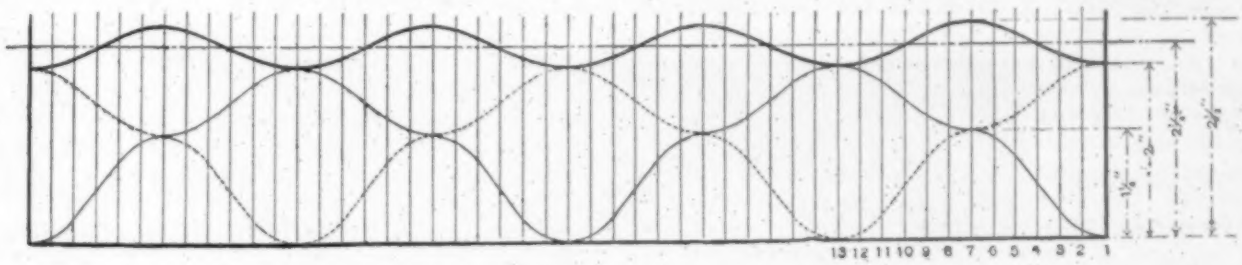


FIG. 3.

force, fluid friction, accurate balancing, etc., as encountered in designing centrifugal machines.

We have up to this time used the word pump in its broader sense, but in considering the uses of rotary pumps the machines used for elastic fluids should be discussed apart from those used for liquids. The action of a rotary pump or blower as an air compressor is practically the same as the action of a duplex, crank-an-fly-wheel, double-acting, piston compressor which has mechanically operated valves opening and closing at the beginning and end of the stroke, assuming the piston machine to have no clearance spaces. There is, therefore, no gradual compressing of air in a rotary machine, and the unbalanced areas of the impellers are working against the full difference of pressure at all times. The possible efficiency of such a machine under ordinary temperature and conditions of

atmosphere, assuming no mechanical friction, leakage, nor radiation of heat of compression, would be as follows:

Compression to one pound gauge pressure 97½ percent.
Compression to two pound guage pressure 95½ percent.
Compression to three pound gauge pressure 93$^{3}/_{10}$ percent.
Compression to four pound gauge pressure 91$^{7}/_{10}$ percent.
Compression to five pound gauge pressure 90 percent.
Compression to ten pound gauge pressure 82$^{7}/_{10}$ percent.
Compound pressure to fifteen pound gauge pressure 76$^{7}/_{10}$ percent.

Regardless of the above facts, concerning the efficiency of this type of machine as an air compressor, a manufacturer recently issued a catalogue, from which the following paragraph is taken:

"The machine illustrated (patent pending) is constructed to stand a pressure of from fifteen to twenty pounds per square inch. In this machine we use a spray of water to pack the machine and prevent backward escapement of air, and at the same time absorb the heat caused by compression. The water is carried over into the separating tank and automatically drained off. This new device, after careful and exhaustive test, proves to be all that we expected of it, and enables us to maintain fully as high an efficiency under high pressures as we can under one pound or less. For work where a pressure of from two to eighteen pounds is required, we are ready to guarantee a very high efficiency. We contend that the principle of the rotary motion applied to air under high pressure eliminates a vast amount of friction, and hence wear and tear; and when high efficiencies can be obtained is far preferable in every respect to the blowing engine."

This reference is quoted to support the position taken—that a machine, when misapplied, cannot be made successful, and such a policy is sure to bring it into bad repute. We consider a rotary machine of this type out of place when working in elastic fluids at more than five pounds difference of pressure. The proper application of rotary positive machines when operating in air or gas under differences of pressures from eight ounces to five pounds is where constant quantities of fluid are required to be delivered against a variable resistance, or where a constant pressure is required and the volume is variable. These are the requirements of gas works, pneumatic-tube transmission (both the vacuum and pressure systems), foundry cupolas, smelting furnaces, knobbling fires, sand blast, burning of fuel oil, conveying granular substances, the operation of many kinds of metallurgical furnaces, etc.

The efficiency of a rotary pump depends on the size, the speed at which it is operated, the pressure under which it is working, and its construction. The capacity varies as the square of the diameter of the cylinders, or distance between gear centres, and directly with the length of the impellers and cylinders. The principal leakage lines are the contact lines between the impellers, and between the impellers and cylinders, as the impellers can be fitted quite closely at their ends. It is obvious, therefore, that in a large machine the per cent of slip due to the working pressure and the clearances is less than in a small one. For example: One blower has a capacity of 12½ cubic feet per revolution, its shaft centres are 16 inches apart, and its impellers 48 inches long; another has dimensions just twice these, and its capacity is 100 cubic feet per revolution, or eight times as great. If we assume the machines to have the same clearances, and running under the same speed and pressures, then the per cent of slip in the larger machine would be only one-fourth that of the smaller, because the leakage lines are twice as long in the larger machine and its capacity is eight times the smaller one.

Since the leakage lines are exposed to the working pressure at all portions of the revolution, the slip is practically constant for a given pressure whether the machine be running fast or standing still. This argues for as high a speed for a blower as is consistent with successful mechanical operation, because the loss due to air friction is inconsiderable if the inlet and discharge are made large. For water, however, questions of velocities are very important, and the speed should be reduced. The theoretical velocity of air at one pound above atmosphere and at a temperature of 62 degrees Fahr. is about 340 feet per second, assuming that for small differences of pressures, where there is relatively small expansion, the velocity of flow follows the law of falling bodies. A cubic foot of air at 62 degrees Fahr. at sea level weighs .076 pounds. The height of a column of air of equal density necessary to produce a pressure of one pound per square inch would be 1,895 feet. If $V = \sqrt{2g}\,H = 8.02\,\sqrt{H}$ then the theoretical flow at the base of the column would be 8.02 times the square root of 1,895, or 349 feet per second, and for small differences we assume that the velocity varies as the square root of the pressure. Therefore, doubling the pressure doubles the load, and increases the slippage to 1.41 times what it was at the original pressure. We have found the above assumptions concerning the slippage in rotary blowers to be practically correct, after having tested hundreds of them by closing the discharge and counting the number of revolutions of slippage at different pressures.

An interesting experience was had with two pumps, each to have a capacity of 25,000 gallons per minute lifted 31 feet, coupled direct to a Corliss engine, running at about 67 revolutions per minute. We designed them with two air chambers on the discharge and two on the suction side of the pumps, placing them as near as possible to the impellers, the air chambers having connections to the pumps 7 inches in diameter. When we began to operate the pumps we found that they would run smoothly up to 50 revolutions per minute, at which speed a powerful water hammer occurred. We attached an indicator to the discharge side of the pump, 18 feet below the upper water level, and found that the pressure there varied from 5 or 6 pounds vacuum to 30 or 40 pounds pressure. The action on the suction side was similar except that the vacuum was about 12 pounds and the pressure rose slightly above atmospheric pressure.

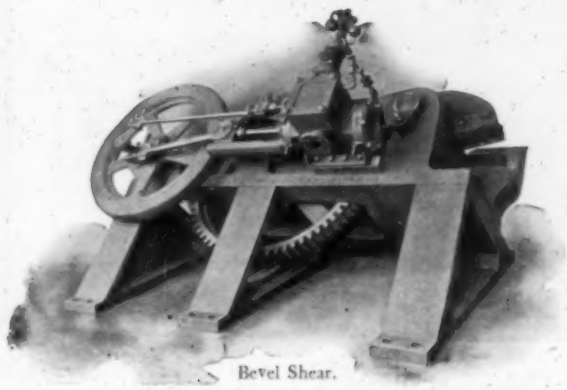
It was this experience which led to the production of the diagram shown in Fig 3. It also caused the writer to investigate the practice concerning air chambers on piston pumps, and we were surprised at the abuses committed by the users of that type of pumps. Mr. F. Meriam Wheeler has brought this matter out very clearly in one of his papers, and it would be well if manufacturers and users of reciprocating pumps would follow his advice.

We corrected the deficiency in capacity of air chambers on the above-mentioned pumps by the addition of more chambers which enabled us to operate the pumps at a speed of 85 to 90 revolutions per minute. Since then we have made pumps having capacities of 35,000, 40,000, and 50,000 gallons per minute which are operating under heads of from 8 to 25 feet, and have had no trouble from water hammer.

The writer has taken many indicator cards from engines operating rotary pumps, and finds the combined efficiency of the pump and engine to be from 80 to 84 per cent. Two large pumping plants are now under way near Beaumont, Tex., for the Treadway Canal & Rice Co., from which we expect to get some excellent records, one plant consisting of four 35,000 gallon pumps, operating under 35 feet head, direct coupled to compound condensing Corliss engines; the other plant consisting of two 70,000 gallon pumps, operating under 10 feet head, direct coupled to tandem compound condensing Corliss engines. These plants are to be operated with oil fuel, and we hope to be able to make accurate duty tests of them and place the records of these tests before the engineering world.

The directors of the Monterey Iron & Steel Co., Mexico City, Mex., have issued a call for the twelfth assessment of five per cent on the subscribed capital of $10,000,000. It is expected that by the end of the year, the plant will be running in all its departments, and that General Reyes, secretary of war, will preside at the formal inauguration of the establishment, which is expected to produce Mexican steel rails cheaper than imported rails.

The Zenith furnace, at Duluth, is again making pig iron after having been out of blast more than a month on account of insufficient supply of coke.



Bevel Shear.

"Largest roll makers in the world, makers of the largest rolls."

5

Modern Plants

operating exclusively on equipment for

Steel and Iron Works and Tube Plants.

Sand, Chilled and Steel Rolls

UNITED ENGINEERING & FOUNDRY COMPANY,

SUCCESSORS TO

McGill & Co., The Lloyd Booth Co., Lincoln Foundry Co.,
Chilled Roll Foundry Co. and Frank-Kneeland Machine Co.

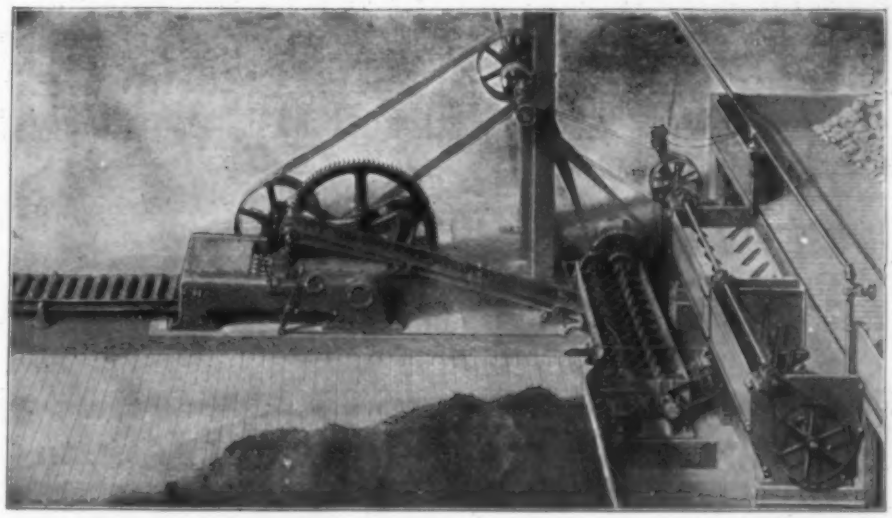
General Office: 54th St. and A. V. Ry. Branch: 401 Bank of Commerce Bldg., PITTSBURG, PA.

WHITE BRIQUETTING PRESS

Does away with evils arising from use of large quantities of fine ore in the furnace. :: :: ::

Saves Flue Dust Waste. Lessens Operating Expense.

Binder available for use with machine to successfully turn out solid waterproof briquettes of iron flue dust or fine iron ore.



Already used by the largest smelter interests in the world for putting precious metal fines into solid block form.

No. 1 White Briquetting Press and Outfit — Built in three sizes — Capacity of No. 1 plant, 100 tons in 10 hours.

MANUFACTURED BY

The Henry S. Mould Company,

Empire Building, PITTSBURG, PA.

THE THEW AUTOMATIC SHOVEL CO.,
LORAIN, OHIO.

STEAM SHOVELS

FOR IRON ORE MINES,
ORE DOCKS AND STOCK PILES,
FURNACE YARDS,
BRICK YARDS and CONTRACTORS.

Operated by one man.
Can be USED AS A CRANE.
Convenient and economical.
WRITE FOR CATALOGUE.

The Link-Belt Machinery Co., Chicago, U. S. A.

Specialists in the design and manufacture of *LABOR-SAVING APPLIANCES* for the handling of materials in bulk or package. Power transmitting machinery, up-to-date coal and ashes handling equipment for power houses, etc., etc. :: :: :: ::

ILLUSTRATED CATALOG No. 28-B JUST OUT—SEND FOR IT.

Philadelphia: THE LINK-BELT ENGINEERING CO.

Crane Buyers.

The monthly machinery issues of

The Iron Trade Review

are read by *Proprietors* and *Works Managers*.

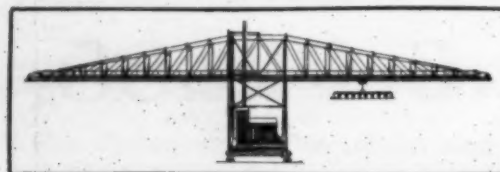
These men are the *buyers* of Cranes.

The Exeter Machine Works, PITTSTON, PA.

NEW YORK OFFICE: 120 Liberty Street. CLEVELAND OFFICE: 807 New England Building.

Manufacturers of

Hoisting Engines for Contractors and Mines. Elevators and Conveyors for Power Houses Coal Yards and Mines.



"Brownhoist" Cantilever Cranes

For Structural and Beam Yards, are the most economical Cranes for covering large storage areas.

THE BROWN HOISTING MACHINERY COMPANY,
WORKS, CLEVELAND, OHIO.

NEW YORK, 26 Cortlandt St. PITTSBURG, Frick Building. LONDON, 39 Victoria St., S. W.

ECONOMIC ENGINEERING

Designing and Building Special Machinery.

Elevating, conveying and storing materials in any shape or form—from one point to another, high or low—is a specialty with us.

In designing, erecting and installing complete plants, we have gained much valuable engineering experience. This expert knowledge is at the disposal of any prospective purchaser or engineer that's interested.

NEW YORK, Graham Building. PHILADELPHIA, 716 Fidelity Mutual Bldg.
PITTSBURG, PA., 701 Empire Bldg.

THE AULTMAN COMPANY, CANTON, O.

The Mechanical Index in the back part of this issue is for the benefit of our readers and should be used by them. It covers thoroughly the lines manufactured by our advertisers.

2 Motor Electric Traveling Crane.

WRITE US GIVING REQUIREMENTS.

CRANES

Our designs of Traveling Cranes for Steel Plants, Foundries or Machine Shops, etc., are not surpassed. Modern improvements and solid, simple and efficient mechanism, place them in front.

NORTHERN ENGINEERING WORKS, No. 6 Chene St., DETROIT, MICH.

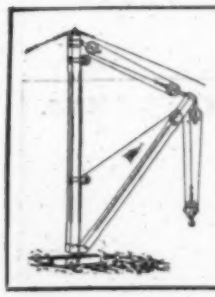
Cleveland Agents: C. E. STAMP & CO., New England Bldg.

CLEVELAND CRANE AND CAR CO

WICKLIFFE, O.

PITTSBURG OFFICE FRICK BLDG

OF ALL KINDS FOR ALL PURPOSES



DOBBIE FOUNDRY AND MACHINE CO.,

NIAGARA FALLS, N. Y.

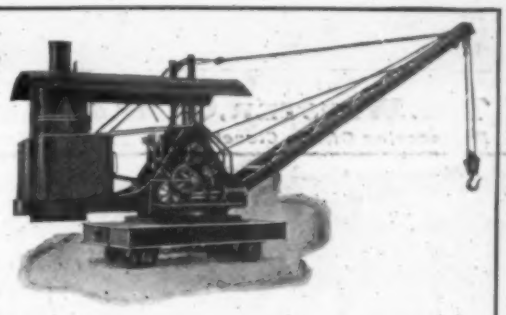
HOISTING MACHINERY, YARD DERRICKS, FOUNDRY CRANES, WIRE ROPE SHEAVES AND BLOCKS.

Branch Office and Store 38 Dey St., NEW YORK.

Locomotive Cranes

IN CAPACITIES FROM

THREE TO SIXTY TONS.



INDUSTRIAL WORKS, Bay City, Mich.

Lidgerwood Hoisting Engines

Are Built to Gauge on the Duplicate Part System, Quick Delivery Assured.

STANDARD for QUALITY and DUTY.

STEAM AND ELECTRIC HOISTS.

20,000 IN USE. Send for Latest Catalogue.

LIDGERWOOD MFG. CO.,

96 LIBERTY ST., NEW YORK.

Chicago, Cleveland, Boston, Pittsburg, Atlanta, Philadelphia, Portland, Oregon, New Orleans.

Overhead Tramrail Systems

are adapted to a thousand and one different uses.

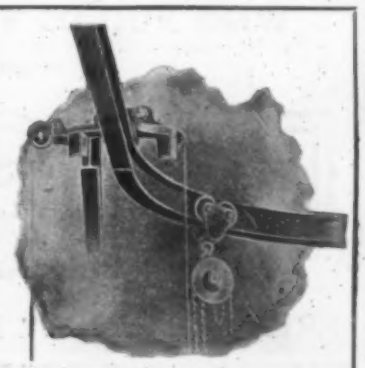
May be you have use for one of our Systems in your shop. Write us about it, we'll be glad to show you where and how it will save its first cost in six months.

Our new 14-page Catalogue will be sent for the asking.

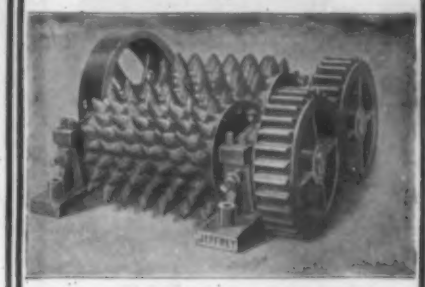
J. W. MOYER & CO.,

1731 Howard St., PHILADELPHIA, PA.

NEW YORK OFFICE: 730 Park Row Bldg.



Jeffrey Elevating Conveying Machinery.



COAL AND COKE CRUSHERS.

New Chain Catalogue Now Ready. Send For Copy.

COAL WASHING, SCREENING, CRUSHING, COAL MINING, DREDGING MACHINERY.

ELECTRIC MINE LOCOMOTIVES.

ADDRESS

The Jeffrey Mfg. Company,

Columbus, Ohio, U. S. A.

NEW YORK. DENVER.

ROBINS SORTING CONVEYORS

Are Far Superior to Picking Tables of Wood and Iron.

New Catalogue just issued.

ROBINS CONVEYING BELT CO.,

19 Park Row, NEW YORK CITY.

Pittsburg Agents: TATE, JONES & CO., INC. Empire Bldg.

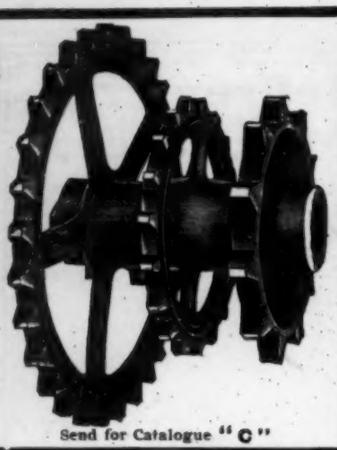
WE CONVEY AND ELEVATE EVERYTHING.

TACKS, SAND, ROCK, ORES, RED HOT IRON, MOLTON SLAG, COAL AND SALT.

CONVEYORS AND ELEVATORS MADE BY

THE C. O. BARTLETT & SNOW CO.

CLEVELAND, O.



Send for Catalogue "C"

Our Business is Cast Iron Machine Moulded Pulleys.

TURNED, BORED and BALANCED.

SPROCKET WHEELS and Chain Belt.
SHEAVE PULLEYS for Rope Drives, Gearing.
SHAFTING, Hangers, Pillow Blocks and General Machine and Electric Castings.

W. A. Jones Foundry & Machine Co.

FOUNDERS, ENGINEERS, MACHINISTS.

142-164 W. North Avenue, . . . CHICAGO, U. S. A.

Brass Founders Finishers

J. J. RYAN & CO.,

68-74 West Monroe St., CHICAGO.

Best Bronze, Babbitt Metals, Brass and Aluminum. *Castings on short notice.* ∴ ∴

Do not forget to use our Mechanical Index in the back part of this issue.

GRAY IRON CASTINGS.

We solicit orders for limited quantities in medium weights.

Richmond City Mill Works,
RICHMOND, INDIANA.

COMPLETE COAL AND ORE HANDLING PLANTS.
HULETT PATENTS.

THE WEBSTER, CAMP & LANE COMPANY, Builders.
Engineering Office: Cleveland, O. Main Office & Works: Akron, Ohio, U. S. A.

PITTSBURGH VALVE, FOUNDRY & CONSTRUCTION COMPANY,

ENGINEERS, FOUNDERS, PIPE FITTERS & MACHINISTS,

STEAM PIPING FOR HIGH PRESSURE POWER.
PLANTS ERECTED BY EXPERIENCED WORKMEN.

PITTSBURGH, PA.

LEATHER BELT.

Slips less than any other make of belt.

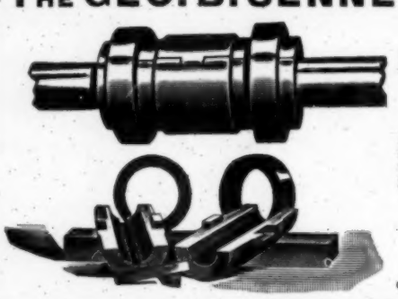
MANUFACTURED ONLY BY
JEWELL BELTING CO.,
27 Trumbull Street,
HARTFORD, CONN.
178 Lake Street,
CHICAGO, ILL.
248 West Somerset Street,
PHILADELPHIA.

THE GEO. B. SENNETT CO., YOUNGSTOWN, OHIO,

MANUFACTURERS OF

SENNETT COMPRESSING COUPLINGS

AND OTHER SPECIALTIES.



We do not claim novelty in these Couplings so much as good material, good workmanship and extreme simplicity. We make them of a very strong cast iron, with wrought iron bands.

We make also the

SENNETT ENGINE

20 to 40 H. P.

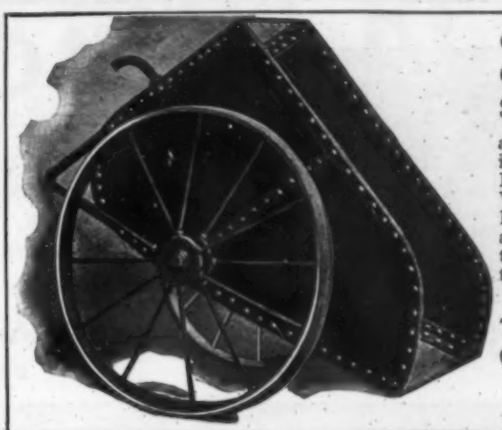
Foundry contracts solicited for duplicate castings, from 10 lbs. to 5 tons each.

WHO BUILDS THE BEST MINE PUMP?

PRESCOTT.

FRED. M. PRESCOTT STEAM PUMP CO., MILWAUKEE, WIS.

Do not forget to use our Mechanical Index in the back part of this issue.



Charging Barrows,
Coal and Coke Wagons,
Steel Wheelbarrows,

all specially adapted for use in Blast Furnaces, Rolling Mills, Smelting Works, Gas Works, Coal and Ore Docks, Railroad Coaling Stations, or any place where large quantities of coarse material are to be moved.

THE AKRON CULTIVATOR CO.,
MANUFACTURERS,
AKRON, O.

Superior Charcoal Iron Company,

Grand Rapids, Michigan,

Manufacturers of Car Wheel, Malleable, Special Cylinder and Strong Foundry Irons.

The well-known brands of Lake Superior Charcoal Pig Iron—

PIONEER, CHAMPION,
ELK RAPIDS,
ANTRIM, EXCELSIOR.

FUEL AND FREIGHT

Important Items to Manufacturers.

COAL. NATURAL GAS. LOW FREIGHT RATES.

FAIRMONT,

THE GREAT FUEL TOWN OF THE SOUTH.

FREE SITES.

Correspondence Invited. FAIRMONT BOARD OF TRADE,

SAM R. NUZUM, Secretary,

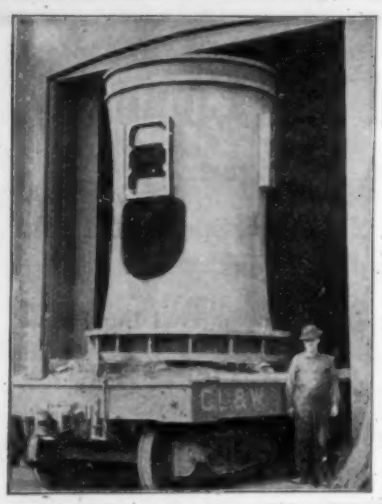
FAIRMONT, W. VA.

Corner in our Roll Department.

ROLLS

SAND, CHILLED, STEEL. CORLISS ENGINES. BLOWING ENGINES. ROLLING MILL MACHINERY. MACHINE MOLDED GEARS. STEEL CASTINGS.

MESTA MACHINE CO.,
PITTSBURG, PA.



Castings for Every Service.

Sand Rolls, Ingot Molds,
Brass and Bronze Castings.

Special Attention Paid to the Requirements of Rolling Mills and Chemical Works.

Mail us blue prints and specifications and secure our estimates. :: :: ::

The Lorain Foundry Company,
Lorain, Ohio.

If you are not pleased with the Steel Sheets you are buying, try us — 16 and lighter.

THE NILES IRON & SHEET CO.
NILES, OHIO.

"Taylor Old Style"

roofing tin

Selected for use on the improvements to the White House at Washington. This brand was used years ago on the main building. It covers almost all the public and government buildings in the United States.

N & G TAYLOR CO., *Sole Makers,* **Philadelphia.**
ESTABLISHED 1810.